825 Ann Street, Fortitude Valley QLD 4006
PO Box 264, Fortitude Valley QLD 4006
ergon.com.au

23 November 2015

Mr Kim Wood
Commissioner
Queensland Productivity Commission
PO Box 12112
George Street
BRISBANE QLD 4003

Dear Mr Wood

SOLAR FEED-IN PRICING IN QUEENSLAND – ISSUES PAPER

Ergon Energy Corporation Limited (Ergon Energy), in its capacity as a Distribution Network Service Provider (DNSP) in Queensland, welcomes the opportunity to provide a submission to the Queensland Productivity Commission (QPC) on its *Issues Paper on Solar Feed-in Pricing in Queensland*.

Should you require any additional information or wish to discuss any aspect of this submission, please do not hesitate to contact the Group Manager Regulatory Affairs, Jenny Doyle, on (07) 3851 6416.

Yours sincerely

Ian McLeod
CHIEF EXECUTIVE

Enc. *Attachment: Ergon Energy Corporation Limited's submission*

Submission on the *Issues Paper on Solar Feed-In Pricing in Queensland*

23 November 2015

Submission on the *Issues Paper on Solar Feed-in Pricing in Queensland*

Queensland Productivity Commission

23 November 2015

This submission, which is available for publication, is made by:

Ergon Energy Corporation Limited

PO Box 264

FORTITUDE VALLEY QLD 4006

Enquiries or further communications should be directed to:

Jenny Doyle

Group Manager Regulatory Affairs

Ergon Energy Corporation Limited

Email: jenny.doyle@ergon.com.au

Phone: (07) 3851 6416

Mobile: 0427 156 897

Introduction

Ergon Energy Corporation Limited (Ergon Energy) welcomes the opportunity to provide comment to the Queensland Productivity Commission (QPC) on its *Issues Paper on Solar Feed-in Pricing in Queensland* (Issues Paper). This submission is provided by Ergon Energy, in its capacity as a Distribution Network Service Provider in Queensland.

Ergon Energy is supportive of the QPC's review into determining a fair price (or fairer prices) for solar power produced at the home or business premises of a small customer and exported into the electricity grid.

The Queensland Government's target of a million solar photovoltaic (PV) rooftops (or 3000MW) by 2020 provides an opportunity to consider the opportunities for solar PVs in regional Queensland in the future. Ergon Energy is committed to play its role in delivering on this commitment, while maintaining safety and reliability standards, and using this opportunity to consider technology advancements such as batteries, commercial and large scale solar installations and new models where other customers may be able to access solar installations (e.g. such as those in rental properties or large residential complexes).

Ergon Energy believes, as regional Queensland's electricity supplier, that we have a responsibility to demonstrate environmental leadership and leverage our business imperatives to support actions that enhance our collective climate change response. In line with this, we have strategically positioned our network as an open access platform for distributed renewable energy resources.

We are changing the way our customers value us from simply providing an essential service to a provider of essential infrastructure that connects and enables buyers and sellers of both renewable and traditional energy sources, which facilitates the associated reduction in greenhouse gas emissions. We already have over 1GW of renewable energy resource capacity now connected, contributing over 11% of the electricity being supplied from our main grid. We have more than 110,000 solar energy systems, exporting around 29GWh of renewable energy every month for distribution to other customers. Our strategic position as an 'open access platform' is supported by a number of key initiatives:

- Enabling an efficient market for renewable integration – we are evolving to a more dynamic way of managing our network, and this, coupled with the falling cost of distributed energy generation and storage, could see 'feeders of the future' operating like a micro grids within critical sections of the main grid. In this scenario renewable energy can be sourced and supplied from strategically located assets, or from our customers' investment in energy solutions, reducing emissions and losses from transporting electricity long distances over our dispersed grid.
- Tripling solar access to the grid – we are supporting the 200 to 300 new solar energy system connections being made each week by leading the way with our innovative adaptation of STATCOM power electronics technology (Static Compensators)[1]. This voltage control technology could potentially triple the number of customers that can connect solar to our urban networks, reducing fossil fuel needs and improving utilisation of our electrical networks.

[1] These devices are connected to the LV network where they absorb and/or export reactive power to assist in the control of network voltage levels.

- An Australian first utility battery and enabling customer battery storage – to support the rural reaches of our network, where we have limited capacity 'SWER' line technology, we have developed our Grid Utility Support System, known as GUSS. The medium scale battery application stores power during off-peak times and feeds it back at peak demand times, reducing losses, conserving resources and helping to build our smart grid strategy. We are engaging with domestic and international leaders in the energy storage field, including SunPower, Sunverge and BYD (for our more recent customer trial of battery electricity storage systems in Townsville).
- Demand management capability beyond expectations – over five-years we delivered 139MVA in demand reductions, the equivalent of removing a city the size of Rockhampton off the grid at peak time, significantly reducing the need to augment the network and supporting energy and materials conservation (and placing downward pressure on prices).
- Reducing our reliance on diesel – in our isolated communities, we are aiming to reduce our reliance on diesel to zero by 2050, using solar, wind and geothermal generation investments. The success of our award winning Doomadgee solar farm led to ARENA funding approval for its expansion, which is aimed at cutting diesel use in the community by 33% and accelerating the renewable rollout in isolated communities across Australia. Our energy saving powersavvy program also works with residents to reduce diesel and associated greenhouse gas emissions. Stage 2 is subject to further approvals.

Ergon Energy is committed to being an active participant in initiatives including the roll out of solar and batteries to deliver a new energy future for Queensland. With the rapid onset of technology development and deployment, including battery uptake, it is possible that solutions to recent emerging issues will be found to enable Ergon Energy's strategy to be an open access platform for technologies including renewables.

In response to the QPC's invitation to provide comments on the Issues Paper, Ergon Energy has focused on a number of general areas, including the regulatory framework and Ergon Energy's experiences since the Solar Bonus Scheme (SBS) commenced. Ergon Energy considers that the QPC should adopt a holistic approach to investigating fair solar feed in prices and as such, it is important for the QPC to gain an insight into both customer behaviours and the impacts of those behaviours on the distribution network. Ergon Energy is available to discuss this submission or provide further detail regarding the issues raised, should the QPC require.

Specific Comments

Ergon Energy supports this review as we consider it an opportune time for the QPC to commence discussions on this matter, particularly as the traditional selling business model is rapidly evolving and new technologies are entering the market. As part of this evolution there is a greater desire to achieve more cost reflective pricing so that not only households and businesses with these technologies save money, but costs are reduced for other consumers as well.

Regulatory Framework

Ergon Energy's service commitments are in line with our legislative obligations. Ergon Energy is obliged under the *Electricity Act 1994* (Qld) (the Act) to operate, maintain and protect its supply

network in a manner that ensures adequate, economic, reliable and safe connection and supply of electricity to its customers.[2] This includes maintenance of voltages and other system parameters within acceptable tolerances. The Act also obliges Ergon Energy to consider both demand and supply side options in order to provide, as far as technically and economically practicable, for the efficient supply of electricity.[3]

Ergon Energy is also subject to economic and other regulation under the National Electricity Rules (NER). As part of our obligations under the NER, in preparing our Regulatory Proposal, Ergon Energy is required to include the total forecast capital expenditure for the relevant regulatory control period which we consider is required in order to meet the capital expenditure objectives.[4] To comply with this, Ergon Energy proposes capital expenditure to 'meet or manage the demand for standard control services'. The Australian Energy Regulator (AER) assesses and approves our capital expenditure for each five year regulatory control period. The cost of Ergon Energy's capital works program is recovered under our approved revenue cap, from all customers via network tariffs. A proportion of our capital expenditure is dedicated to augmentation of the network where constraints are identified. The level of augmentation expenditure proposed for the 2015-20 regulatory control period is significantly lower than the expenditure allowance in the 2010-15 regulatory control period.

This reduction in approved augmentation expenditure is predominately as a consequence of recent changes to Ergon Energy's Distribution Authority, which have resulted in a significant reduction in the number of constraints on our network. Specifically, in September 2014 the Queensland Government issued Ergon Energy a new Distribution Authority which flat-lined the Minimum Service Standards at 2010-11 levels and introduced probabilistic security standards (as opposed to a deterministic N-1 approach) and a Safety Net. This in turn led to a significant reduction in the level of augmentation required, as reflected in both Ergon Energy's Revised Regulatory Proposal for 2015-20 and the AER's subsequent Regulatory Determination for the period.

This essentially means that there is expected to be only a limited number of constraints that need to be addressed in the current regulatory control period. A broad based Feed-in Tariff (FIT) does not remove these constraints as it there is no guarantee that customers on the constrained feeder will respond in a way that addresses the constraint, and as noted further in our submission, the intermittency of generation means that, even if customers on the constrained feeder do respond, it cannot be relied on to lower peaks.

In relation to the Terms of Reference as it relates to any network benefits, noting that Ergon Energy is funded to address known constraints within the period, a FIT does not address those constraints. In particular a DNSP receives no benefit where a FIT is paid to customers who install technology that does not address a specific constraint for which we are funded through our revenue cap. Such a requirement from a constraints management perspective would result in compensation for customers who are not directly addressing the constraint for which the funding was allocated. Further, including perceived benefits to the network in the determination of a retailer funded FIT would also be inappropriate given it does not address constraints of the network.

---

[2] Refer section 42(c) of the *Electricity Act 1994* (Qld).
[3] Refer to section 42(e) of the *Electricity Act 1994* (Qld).
[4] Refer to clause 6.5.7(a) for the capital expenditure objectives.

In Ergon Energy's view the most appropriate way to address constraints on our network is through targeted offerings to the customers we want to incentivise on the basis of their ability to contribute to the resolution of the constraint. This could be through a variety of means including our funding of solar, batteries etc. on the customer's installation, entering into demand management contracts with customers (which may include incentive payments), working with retailers to offer products, or working with aggregators to deliver the desired capacity.

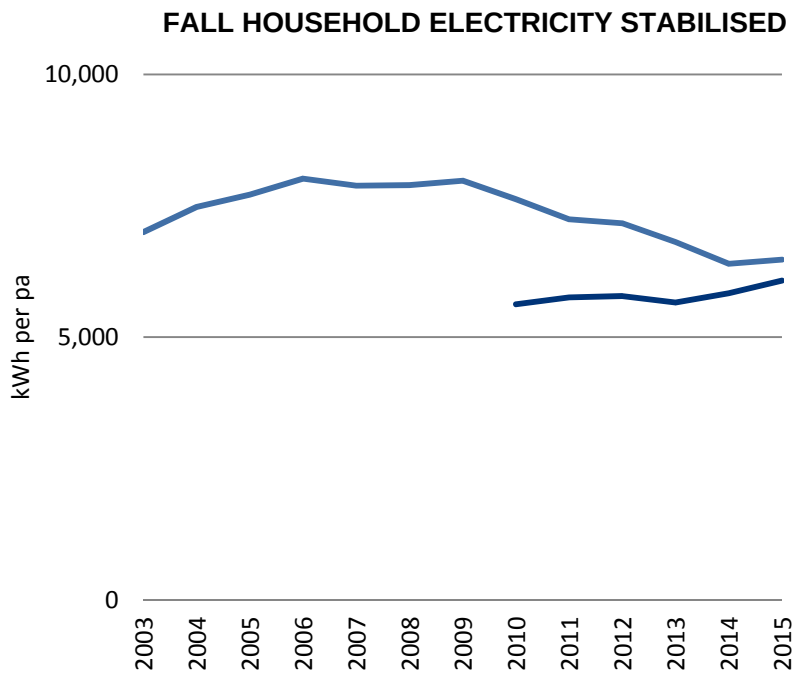
In this regard, Ergon Energy notes that it has obligations under Chapter 5 of the NER to undertake a Regulatory Investment Test (RIT-D) where the most expensive credible option to address a constraint is more than $5m. In undertaking the RIT-D, Ergon Energy is required to screen for non-network alternatives. Ergon Energy also publishes a Distribution Annual Planning Report which sets out information on our planning processes. This includes maps of all our forecast constraints. Further, Ergon Energy provides information on its website on our demand management programs and trials and how customers can be involved. Taken together, this provides detailed information for customers and interested stakeholders on likely network constraints and how they may be able to work with us to address them.

Impacts of Solar

Due to the significant costs associated with installing a solar system at the commencement of the Queensland Government's SBS, most customers who pursued this option did so with the environment in mind. However, as generous government rebates and FITs became available, the mind-set of new solar PV customers in some cases appears to have progressively shifted from an environmental one to one driven by price and financial considerations. In Ergon Energy's experience, decisions about whether to install solar are now often commercially driven. In simple economic terms, some customers want to receive a return on their investment, as well as manage their bills and have been able to do so because of decreasing costs of the solar systems and generous Federal Government rebates.

At the end of October 2015, 113,705 customers in the Ergon Energy distribution area have connected solar energy systems to our network – the total capacity installed is now 422 MW. This is seeing around 29,000 MWh of renewable energy exported into Ergon Energy's network every month and distributed to other customers.

As the graph below illustrates, during the past year the fall in the amount of electricity being used by the average household without solar energy systems across regional Queensland has stabilised. At the same time, the electricity being used by households with solar has continued to increase on average.



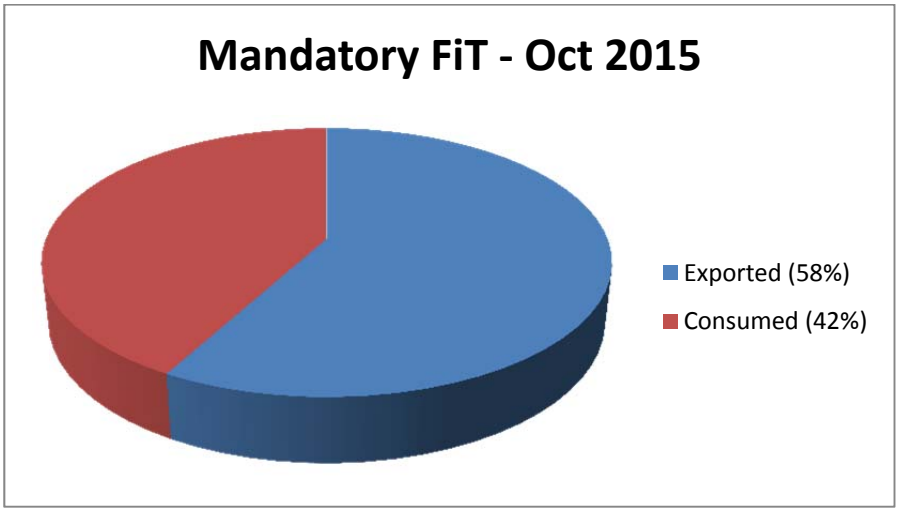
** The average residential consumption is based on Ergon Energy Queensland Pty Ltd accounts on a combination of regulated tariffs, excluding households with solar PV systems installed. The second trend line shows households with solar energy systems installed.*

However, Ergon Energy has found that there has been a steady increase in the amount of solar PV generation exported from customers' premises regardless of which FIT they are receiving. In particular, we have seen that the increase to the volume exported for customers receiving either the mandatory (retail funded) FIT or the 44c/kWH FIT is due to the increasing inverter capacity of the systems being installed.[5]

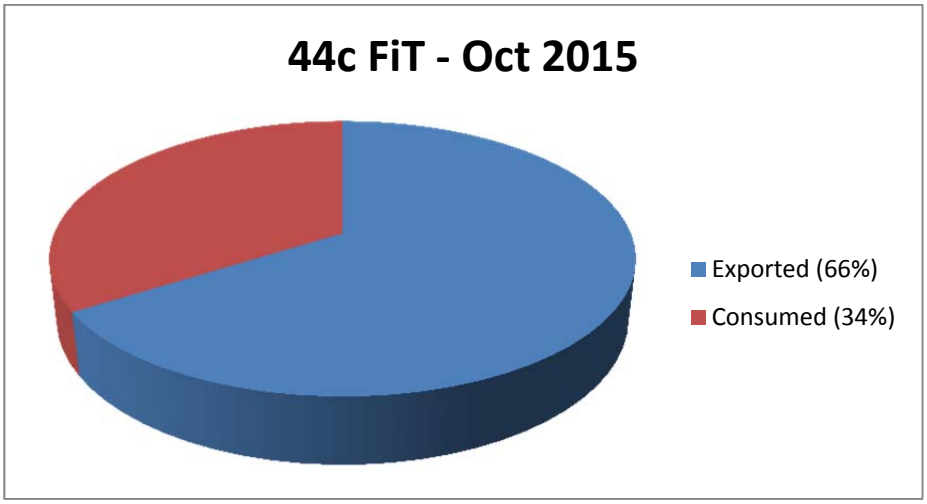
The importance of highlighting this is to demonstrate that some customers are focusing on the financial opportunities when installing a system or adding additional array capacity. The following pie graphs demonstrate the difference between solar PV generation exported and consumed on both FITs.

The following pie graph shows the percentage of PV generation exported and consumed on the mandated retailer funded FIT. It is based on rolling 12-month averages of export percentages and assumes 4.2 kWh of generation per kW of PV capacity per day.

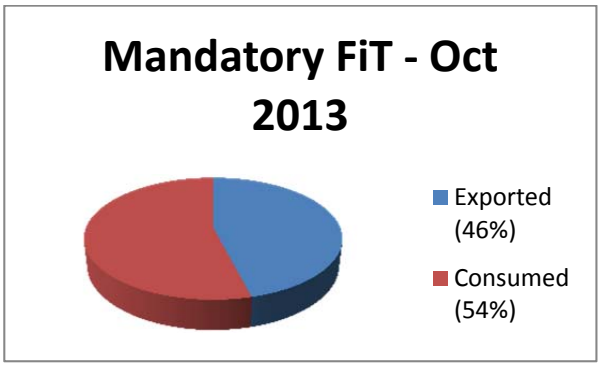
[5] An increase in array size will not impact a customer's eligibility for the 44 cents/kWh FIT rate.

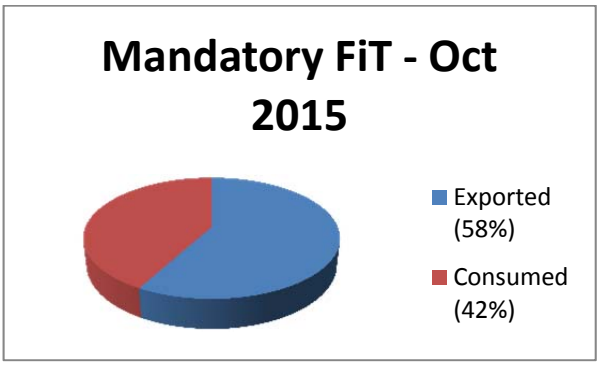


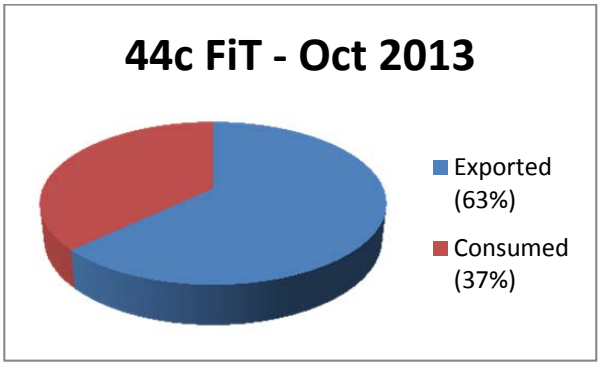
The following pie graph shows the percentage of PV generation exported and consumed on the 44 cents SBS. It is based on rolling 12-month averages of export percentages and assumes 4.2k kWh of generation per kW of PV capacity per day.

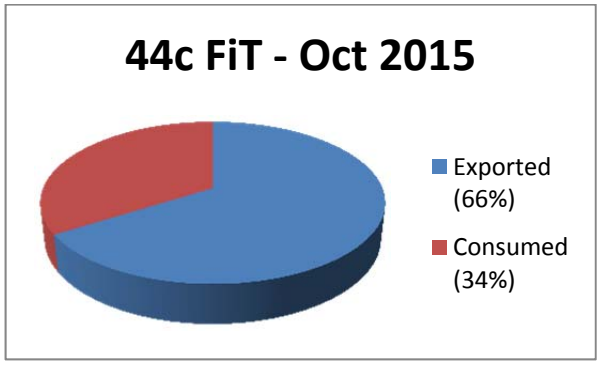


To further illustrate the trends, the following graphs were developed from the data of two years apart:

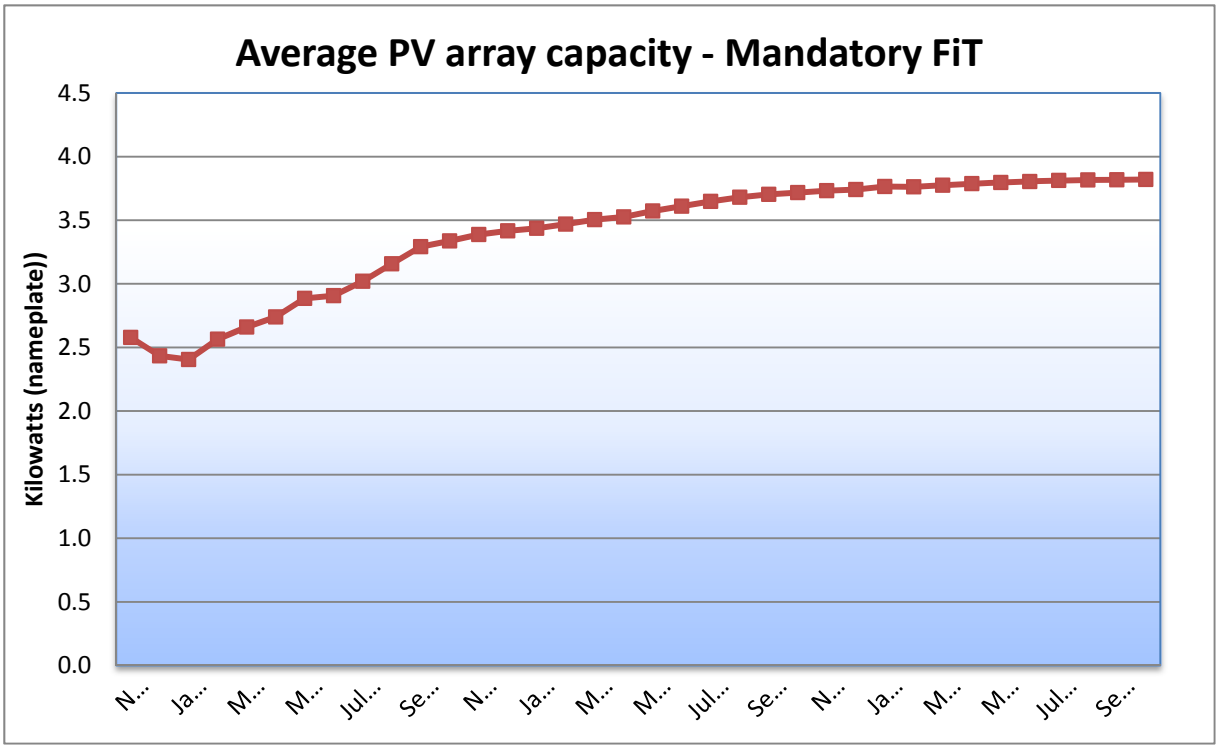




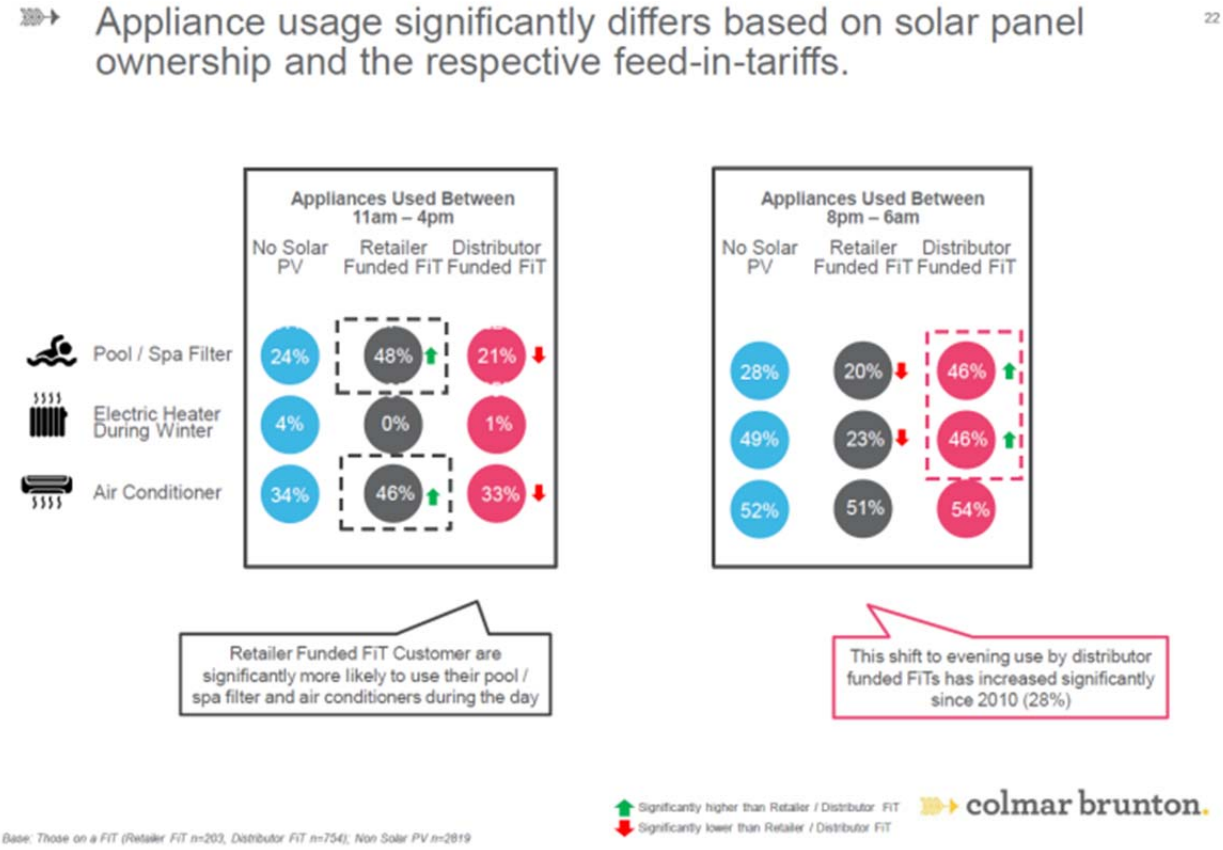




The following graph shows the increase in average array capacity under the retailer funded FIT, which has contributed to the noted increase in export volume, demonstrated by the first of the pie graphs above.



The 2014 Queensland Household Energy Survey 2014 found that customers with the 44c/kWH FIT are more likely to shift their large appliance usage into the evening. Customers on the retailer funded FIT are more likely to shift their large appliance usage into the daytime. This is demonstrated in the following diagram.

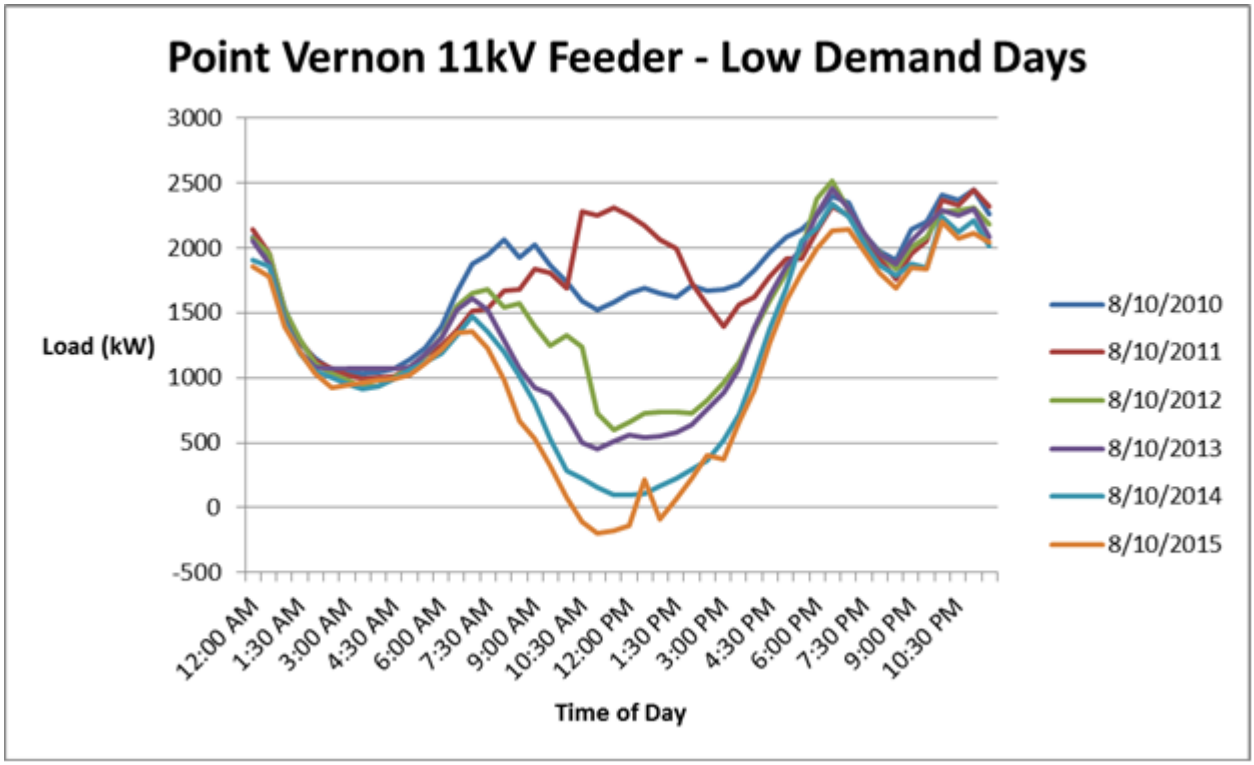


Emergence of the 'Duck Curve' in Network Load Profiles

The reduction in demand for electricity from the grid due to solar PV generation is being defined on an increasing number of distribution feeders and to an increasing degree. When comparing year-on-year load profiles (i.e. on the same day of the year, the hottest day of the year, or day of highest demand) for the same feeder which has relatively high solar PV penetration, demand reduces significantly in the middle of the day, when less electricity is required from the grid, though, remains relatively stable either side of that period. This phenomenon is often referred to as the 'duck curve'.

By way of example, the graph below represents the 'duck curve' for the Point Vernon feeder in Hervey Bay, showing the demand on that feeder on the same calendar day each year over six years. As demonstrated by the graph, the mid-day demand each year is generally lower than the year before, and while the morning peaks are also lowering, the evening peaks are virtually unchanged. This suggests that there is some degree of shifting of load into the peak evening period by customers on the 44 cents/kWh FIT rate which could be due to a variety of reasons and is not necessarily intentional.

In 2015, the midday trough was so low that the PV generation was meeting all of the demand on the network for two short periods and as a result, reverse power flow (RPF) occurred through the local substation. In fact, the mid-day trend suggests that in the near future, the combined level of export on the Point Vernon feeder will exceed the combined demand, resulting in sustained RPF through the local substation.



Reverse power flows

Traditionally, power grids have pushed power in one direction, from the power station to the customer. With the increase in the number of solar PV connections, bi-directional flow is becoming more common. RPF is simply defined as the phenomenon where generation exceeds demand for a feeder or transformer.

RPF at the medium voltage (MV) feeder level is an indicator of significant RPF at the low voltage (LV) network level as well as a precursor to MV voltage rise. RPF at the LV network level results in LV voltage rise which causes exceedances of acceptable voltage supply levels and significant reduction in local solar PV system performance. Both of these outcomes ultimately result in quality of supply (QoS) complaints which often require augmentation of the local LV network in order to resolve. MV network voltage rise further exacerbates voltage constraints on the LV network, with even minor levels of MV voltage rise likely to significantly increase both the frequency and severity of LV network voltage constraints and thus, quality of supply complaints.

The costs associated with RPF can be seen on Ergon Energy's 11kV Takura Feeder in the Wide Bay region. We recently analysed this feeder to determine the likely implications of the forecast increase in the number of solar PV connections and subsequent impacts of RPF. The feeder currently has a solar PV penetration of 1 in 4. This has resulted in a total of 30 PV-related QoS complaints for the feeder, with 16 being raised in 2015 alone. Analysis of this feeder with solar PV connections forecast out to 2025 indicates that the number of constraints and associated QoS complaints is likely to increase steadily each year. There are a number of solutions to resolve these constraints, with significant variations in associated costs. We found that LV STATCOMs (Static Compensators) were found to be the least cost option for resolving solar PV-related voltage constraints, costing 25% of that of traditional augmentation. This is based on the assumption that

the adoption of the 230 V[6] standard proceeds. Despite the considerably lower solution costs of the LV STATCOM solution, the resolution of solar PV-related voltage constraints on this feeder is likely to cost in the order of $286,000 by 2025. Costs are likely to be significantly higher for any alternatives[7] considered.

Costs to the network

The mass take up of solar PV systems is a significant step change that has resulted in a number of issues in Ergon Energy's low voltage (LV) distribution networks as noted in this submission. The requirements for network upgrades alone associated with solar systems are forecast to cost approximately $44m ($14-15) out to 2020. Further information on our forecast costs is included in our revised Regulatory Proposal.

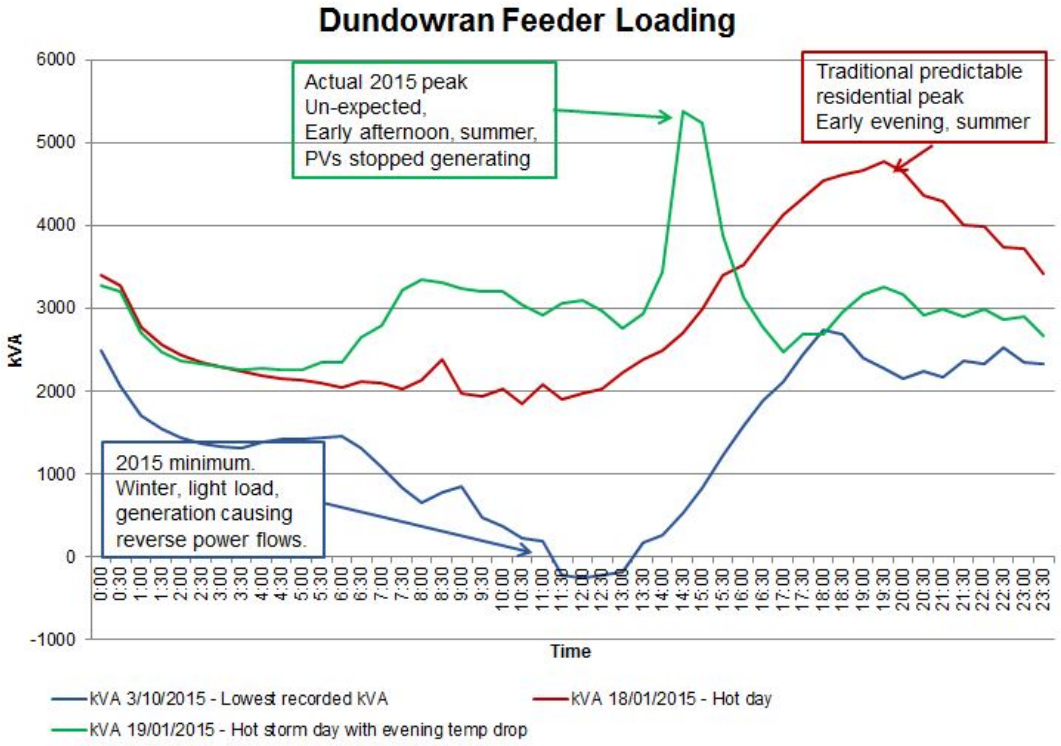
As previously stated however, there are also opportunities. With the rapid onset of technology development and deployment, including battery uptake, it is possible that solutions to recent emerging issues will be found to enable Ergon Energy's strategy to be an open access platform for technologies including renewables and provide network benefits including network stabilisation.

Feeder Peaking

Feeder peaking occurs when solar PV generation is reduced (e.g. due to a sudden change in weather conditions), such that the load ordinarily supplied by the solar PVs at premises connected to that feeder, is suddenly required from the network. This results in a new unexpected peak on the feeder, causing it to become overloaded. The Figure below is an example of 'feeder peaking' on the Dundowran feeder and is useful for demonstrating that while solar PV generation patterns may generally correlate with normal day time peaks, given the intermittency of solar PV generation, it is not a reliable source for demand deferral or as an alternative to augmentation.

Please refer to Appendix 2 for information on the Dundowran feeder peaking.

[6] Ergon Energy is engaging with the Queensland Government seeking a change to the current nominal low voltage of 240V/415V ±6% (254.4V – 225.6V) to 230V/400V +10% to -6% (253V – 216.2V).
[7] Alternatives include traditional augmentation, LV STATCOMs or adoption of the 230V Standard. These can be individual alternative or a combination of alternatives.



Utility Scale Solutions

Ergon Energy also notes that there is increasing interest in utility scale solar solutions. Utility scale refers to solar panel installations that are scaled up to a size that makes them practical for large-scale use, in contrast to residential-scale solar panels. Such installations are flexible in their capacity, ranging from small-scale (<1 MW) to larger-scale (≥1 MW), and can use existing infrastructure within the built environment, for example, collective residential rooftops, commercial rooftops etc.

Utility-scale solar energy systems are uniquely advantageous with their large economy of scale, compatibility with a wide range of sites, and numerous environmental co-benefit opportunities, including their ability to reach national carbon targets.

Ergon Energy's Major Customer Connection Group handles solar enquiries above 30 kVA. Currently Ergon Energy has the following solar projects (number and total size) on our books:

- Prefeasibility solar projects – 15 projects with a combined capacity of 475.3 MW. These projects have not commenced the "connection process" under the NER and may potentially progress to a connection, but will be dependent on a number of factors, such as the customer's funding arrangements and whether the project is determined to be economically and technically viable.
- Active solar projects - 57 exporting solar projects with a combined capacity of 2,311 MW and 53 non-exporting solar projects with a combined capacity of 5.769 MWs. By 'active' we mean that that customers have commenced the connection process under the NER, this may include a connection enquiry or a connection application.
- Completed solar projects – 98 completed non-exporting solar projects with a combined capacity of 8.239 MWs. There are no completed exporting solar projects.

These figures demonstrate that there is significant interest in commercial scale solar installations that could have significant beneficial economic impacts and we recommend the QPC take this into consideration in developing the FIT so as to ensure a policy for residential solar does not crowd out utility scale investment.

Environmental

Ergon Energy supports the continued setting of climate change targets at a national level. We consider that generation from renewable energy sources would have been considerably lower were it not for the Renewable Energy Target (RET) Scheme.

The current RET Scheme has a target of 45,000 GWh by 2020. The Scheme comprises two components, the Small-Scale Renewable Energy Scheme (SRES) covering generation from small scale sources (systems less than 100kW and electricity displacement technologies), and the Large-scale Renewable Energy Target Scheme (LRET) (for systems larger than 100kW). Ergon Energy understands that the division of the Scheme into two threshold components was due to concerns that the rapid uptake of small scale systems would lead to the crowding out of investments in large scale systems.

When analysing the components that determine the value of a FIT, Ergon Energy agrees with the views expressed by the Queensland Competition Authority (QCA) in its 2012 Issues Paper for Estimating a Fair and Reasonable Solar FIT in Queensland,[8] that under the RET scheme, retailers face costs for all purchases of energy from a grid with greater than 100MW of installed capacity. This would include the vast majority of PV exports in Queensland. As a result, RET scheme costs are unavoidable when a retailer on-sells PV exports and should be excluded from a feed-in tariff.

Ergon Energy is aware that some customers and PV industry members are calling for the reduction in greenhouse gas emissions brought about by the installation of solar PV systems, to be reflected in the mandated FIT in Queensland, to reward customers for bringing about that benefit. However Ergon Energy considers that to do so would result in customers effectively being rewarded twice for their environmental contribution. Specifically, the environmental benefit of each eligible solar PV system has already been recognised, and the customer financially rewarded, via the Federal Government's SRES. This is explained in more detail below.

Under the SRES, Small-Scale Technology Certificates (STCs) apply to each qualifying PV system (or micro-hydro or micro-wind unit, or heat pump or solar hot water system). In the case of a solar PV system, one STC is deemed to equate to 1MWh of electricity generated over 15 years following its installation.

An STC is a tradable commodity and has a maximum value in the Clean Energy Regulator's Clearing House of $40, but its price has fluctuated notably over the course of the SRES, reaching below $20 at one point. More recently, it has consistently traded close to $40.

[8] http://www.qca.org.au/getattachment/6dfadc81-cb8e-41a3-90ed-8e080a5acacd/Issues-Paper.aspx, Green Scheme Costs, pg.10.

To provide an example, a typical 4 kW solar PV system in Rockhampton should attract 82 STCs. This is understood to be calculated as follows:

4 kW x 3.75 kWh of generation per day per kW x 365.25 (average number of days per year) x 15 years = 82.181 MWh, therefore 82 STCs.

Note, the 3.75kWh per kW per day formula apparently used by the Clean Energy Regulator is more conservative than the 4.2kWh per kW per day formula described by the Clean Energy Council and others and used by Ergon Energy to develop the earlier graphs of consumption and export proportions.

Assuming that STCs are assigned by the customer to a PV retailer at a value of $37, the PV retailer may provide the customer with a discount on the purchase price of the PV system of $3,034.

The *National Greenhouse and Energy Reporting (Measurement) Determination* for 2008 provides methods, criteria and measurement standards for calculating greenhouse gas emission and energy date under the *National Greenhouse and Energy Reporting Act 2007*. The Measurement Determination is updated annually to reflect improvements in emission estimation methods. The 2015-16 Determination advises that the emissions resulting from 1MWh of electricity consumption in Queensland is 0.79t CO2-e/MWh. Therefore, an average 4kW solar PV system is deemed to reduce greenhouse gas emissions over the first 15 years of its life by almost 65 tonnes (82MWh x 0.79t CO2-e). When considered against the financial value the customer received from the PV retailer through the SRES ($3,034), that equates to a value of $46.84 for each tonne of emissions avoided. Ergon Energy's view is that the Federal Government's SRES rewards PV owners for the environmental benefit of their PV generation; as such the QPC should take this into consideration in developing the FIT.

Connections Process

As noted above, Ergon Energy has facilitated the connection of more than 110,000 solar PV systems to its network. Ergon Energy has invested heavily to assist customers with the approval and connection of solar PV, with the majority of solar applications processed within 24 hours and an agreement or notification returned to the customer within 5 working days. The current timeframe to complete a technical assessment and return a subsequent agreement or notification to a customer is 5 weeks which is within timeframes established under the National Energy Customer Framework.

Ergon Energy is working closely with the government and solar industry, to give customers greater choice and control over how they source and use power and is working on options to assist meet the Government commitment. To assist, Ergon Energy has developed new standards that allow customers to install any solar energy systems up to 30kVA, provided they do not export into the network. As noted above, the business has also built a number of our own installations across the state including a solar farm at Doomadgee and is trialling batteries and solar in residential homes in Townsville.

Improved Application Processing and Industry Engagement

To facilitate the adoption of solar PV unit Ergon Energy has introduced an online application process for new solar PV unit connections and has a dedicated Solar Support Team resourced to assess and provide network agreement to approved applications.

To improve engagement with both solar customers and PV retailers/installers, Ergon Energy has led active engagement through establishing its Micro Embedded Generating Unit Industry Working Group, which holds quarterly sessions with key partners from the Queensland solar industry including the Australian Solar Council, Clean Energy Council, Department of Energy and Water Supply, and Energex.

Engagement with the PV industry has also been increased through the PV Industry Alerts information notifications regularly issued by Ergon Energy and the RECESS Forums being conducted across regional Queensland, that provide informative sessions for electrical contractors/solar installers and an opportunity to provide two-way collaboration with Ergon Energy.

Ergon Energy has also updated its website and other commination channels to establish the business as a trusted advisor when it comes to emerging technologies - not only solar, but also battery storage and electric vehicles.

Solar PV Standards and Thresholds

Ergon Energy has worked with Energex on several aspects of improving the solar application process including introducing reactive power control and non-export standards which are detailed in the joint Connection Standard Small Scale Parallel Inverter Energy Systems up to 30 kVA - Standard that came into effect 1 July 2014, and the alignment of technical assessments to ensure a comparable evaluation criteria is used across both DNSPs.

This standard provides assessment thresholds for the connection of new solar PV units capable of exporting to the network. Where a system is above the threshold, a technical assessment is required.

Thresholds for exporting solar PV units connecting to Ergon Energy's network are:

- >3.5kVA for single and 2 phase premises on the main network
- >10kVA for 3 phase inverter on existing 3 phase premises on the main network
- >2kVA on SWER networks
- >0kVA on Isolated networks

These assessment thresholds are designed to protect customers and increase the likelihood that solar PV units operate correctly and meet Queensland voltage statuary limits. The thresholds also assist customers to get the most out of their system. If the system does not pass the technical assessment, the customer can still install the solar PV unit if they reduce the size of system/inverter or install an approved power limiting device.

A technical assessment has two main benefits; it can help a customer avoid investing in a PV system that won't operate effectively; and it reduces the need for Ergon Energy to undertake costly network upgrades purely to support solar PV – currently these network upgrades are ultimately paid by the entire customer base via the network component of electricity prices.

Ergon Energy and Energex have also worked together to ensure the connection process for larger systems is as similar as possible. Connection standards for the size categories of systems have been developed jointly and are published on the Energex and Ergon websites:
Customer Standard for Parallel Embedded Generation via Inverters – >30 kW to 5000 kW - Standard 00233
Standard for Embedded Generation (5MW and Above) - Standard 1188 (578kb)

230 Volt Trial and AS4777

Ergon Energy will conduct a trial in early 2016 to set voltages of parts of its network to 230V as compared to the current 240V. Based on the outcomes of this trial, Ergon Energy will consider a wider project for the complete transition of the network to a 230V standard over a five year period to provide a greater voltage range to operate the network within.

With increased pressure on the low voltage network predominately due to the uptake of inverter energy systems (IES), which is resulting in increased low voltage network augmentation, the larger voltage range offered through the 230V standard would provide an opportunity to avoid or defer the need for these augmentation works.

The benefits of the full transition to the 230V standard would not only include reduced network augmentation costs, but fewer customer voltage complaints, customer equipment will last longer (as new equipment is mostly rated at 230V), and Queensland's voltage standard would then align with the rest of Australia, New Zealand, and Europe.

Separately, Ergon Energy is waiting for the commencement of the revised AS4777 so it can leverage more advanced inverter functionality that will become standard in inverters, and therefore allow greater penetration and larger inverter systems to be connected to the network, ultimately resulting in lower associated costs for all parties and greater options for customers. Ergon Energy has supported the development of this standard by being instrumental in the AS4777 standard drafting and development committee.

Ergon Energy is committed to being an active participant in initiatives including the roll out of solar and batteries to deliver a new energy future for Queensland. With the rapid onset of technology development and deployment, including battery uptake, it is possible that solutions to recent emerging issues will be found to enable Ergon Energy's strategy to be an open access platform for technologies including renewables.

Table of responses to Queensland Productivity Commission questions

Question(s)	Ergon Energy Response
When should solar export prices be regulated?	
• Is there evidence of significant and enduring market failures in the solar export market in Queensland?	Ergon Energy notes that the initial SBS was generous, offering customers with PV installations 44 cents per kWh for their net exports of power to the network. This scheme was closed to new applications from 9 July 2012. While the original scheme has closed, eligible customers will continue to receive the higher 44 cent rate until 2028. The costs of this scheme are well documented in the QCA's final report on Estimating a fair and reasonable feed-in tariff for Queensland.
• If so, is the investment in solar PV suboptimal (from a societal point of view)?	Ergon Energy considers that the most effective market will be created by a technology-agnostic approach that encourages the consumption and/or storage of the distributed generation at the site with minimal export.
What are the objectives of a solar exports pricing policy?	
• What are the objectives of a solar export pricing policy?	Ergon Energy agrees with the QPC's range of possible objectives for solar export pricing identified in the Issues Paper, including: o encouraging solar PV investment; o solar industry development and job creation; o lowering electricity prices; and o improving environmental outcomes. In addition and expanding on the above, we consider that other objectives of a solar export pricing policy should be to facilitate solar PV take-up for servicing of private premises electricity needs.
• Where objectives are in conflict, which objectives take priority and why?	In balancing objectives, Ergon Energy recommends that the long term benefits are given priority over shorter term benefits and that any policy developed is flexible to accommodate changes to objectives over time. If we look at the objectives of the 44 cents/kWh FIT SBS, where the some of the policy objectives in developing this FIT were to : o promote the uptake of solar PV systems; o To offset the environmentally unfriendly coal based generation in Queensland; o To assist small customers who wish to utilise more environmentally friendly sources of energy.

	The Government at the time decided that the SBS would be funded by the network businesses offering a credit of 44 cents/kWh for net exported energy against a customer's network charges. The popularity of this FIT SBS exceeded all expectations and thus meant that the Government's objective was met earlier than anticipated. As such, any objective must be able to shift as policies are met and the market changes.
Policy and pricing principles	
• What principles should be used to guide solar export pricing policy and any regulation of feed in tariffs?	Ergon Energy supports the identification in the Issues Paper of the Organisation for Economic Co-operation and Development principles of good regulation. We also, support the common policies and how they may apply to solar export pricing identified by the QPC in their Issues Paper, including: fairness; efficiency; equity considerations; neutrality, simplicity and robustness. In terms of technological neutrality, Ergon Energy considers eligibility for a FIT for electricity exported from batteries or other renewable generation sources, such as wind or hydro turbines, would create positive holistic outcomes.
• How should fairness be defined?	Fairness is difficult to define, but traditionally it relates to broad areas such as social policy, equity and related issues. The QCA's Statement of Regulatory Pricing Principles, August 2013 outlines the difficulty in defining this. They provide, 'There is no objective standard of "fairness"' (Friedman 1977). Handler (1936) points out that: What was fair yesterday may be unfair today. What is deemed unfair by one group of business men may be regarded as eminently proper by another. What is offensive to a commission may be palatable to the courts. There are other variables. Practices that are economically justifiable in one industry may be reprehensible in others. What is harmless to competitors may be harmful to consumers and vice versa.'[9] Ergon Energy suggests that the QPC have regard to the QCA's Statement of Pricing Principles[10], and in particular the analysis that economic efficiency should be considered as a fairness criterion.
Factors that can be considered in estimating a price for solar exports	
• What are the costs and benefits of exported solar electricity?	In summary, the costs to the electricity networks of exported solar electricity are already significant and growing for the foreseeable future as more distribution feeders reach a

[9] Section 4.1, pg. 20.
[10] http://www.qca.org.au/getattachment/239b5385-ad9f-4717-8fce-ec437111dbc6/Statement-of-Regulatory-Pricing-Principles-(Aug-20.aspx

• Who incurs the costs and accrues the benefits from exported solar electricity? How will future market developments impact on costs and benefits?	tipping point of PV penetration, especially when RPF begins to occur on an increasing number of feeders. Ergon Energy refers you to our comments above. **Costs**: Facilitating exported electricity imposes costs on both customers and electricity distributors. As more electricity is exported to a local grid, network voltages are pushed higher and all exporting PV systems on that local network will have a restricted ability to export before they trip-off, not only ceasing to export but ceasing to operate for a period of time. The overall effect of this is two-fold: • Higher network augmentation costs, resulting in higher network charges for all customers; and • reduced savings for solar customers as a consequence of limits on export capability described above. Ergon Energy refers you to our comments earlier in the submission for more information. **Benefits:** Customers earning the regulated FIT receive a direct benefit and retailers avoid some costs as noted in their final report on Estimating a fair and reasonable feed-in tariff for Queensland. Ergon Energy also notes that exported solar electricity can contribute to a reduction in peak demand on a small proportion of distribution feeders with day-time peaks. However, the reductions measured to date are marginal and cannot be wholly relied upon so cannot be shown to have deferred any network augmentation, or likely to defer any network augmentation in the foreseeable future (refer to Appendix 1). **Impacts:** In terms of how market developments will impact costs and benefits, it's very unlikely the rate of connection of FIT eligible solar PV systems will increase from current levels, regardless of the FIT rate, so the predicted decrease in volumes will reduce upward pressure on some costs. However the largest cost, of network augmentation, will likely remain fairly similar to previous years, or even increase, as more distribution transformers and feeders reach tipping points that trigger network upgrades.
Review mechanisms and timeframes	
• When should the feed-in tariff be reviewed or updated?	Ergon Energy agrees with the QPC that annual reviews provide the greatest flexibility to adjust the FIT rate as market conditions change.
Barriers to a market for solar exports	
• What are the main barriers to pricing solar exports? How significant are these barriers?	One of the main barriers to pricing solar exports is being able to adequately define the value of the components involved (e.g. transmission, distribution, retail, environmental, policy etc.) and then having the benefiting party paying for that value.

	Under the current SBS; all PV exporters are rewarded equally, even though their exported electricity has a wide range of negative to positive impacts on the network, electricity industry participants and other customers. Essentially, the SBS incentivises some customers to increase the negative impacts of exported electricity, but fails to adequately reward other customers for their valuable exports or incentivise them to export more.
• How may broader market changes (e.g. metering) impact barriers?	The AER is authorised to exempt persons or classes of persons from the requirement to hold a retailer authorisation. The Retail Rules provide for three different types of exemption: • deemed exemption; • registrable exemption; and • individual exemption. The AER has developed Exempt Selling Guidelines to assist stakeholders and explain how to obtain an exemption. What is relevant about this is that the AER in their current Guideline recognise "that Solar energy is another form of decentralised energy. Mostly, people buy solar panels for their own use and feed any surplus into the grid. But where a business installs panels at residential or commercial premises and retains ownership of the panels, that business is effectively selling electricity. Again, because of the diversity of the business models, we have not developed a specific exemption class for any solar panel related sale of energy."[11] This is a market change that the AER is aware of in terms of traditional business models evolving and we think that the QPC should have regard for these changes when looking at establishing a FIT.
• Can these barriers be overcome in an effective and efficient way?	Ergon Energy considers that they can be overcome. This can be achieved by ensuring that the policy behind a FIT development, allows the market to decide technology winners. Alternatively, broadening the SBS to capture other technologies on a technology agnostic basis.
• Are there other barriers to a well-functioning solar export market?	Ergon Energy's data shows a steady increase in the average array capacity of PV installations. The key reason for this is the reducing cost differential between, for

[11] Page 30, *AER (Retail) Exempt Selling Guidelines,* version 3, April 2015, https://www.aer.gov.au/system/files/AER%20%28Retail%29%20Exempt%20Selling%20Guideline%20-%20version%203.pdf

	example a 3kVA and 5kVA system. We are aware anecdotally that some PV sales consultants sell some customers much higher capacity PV systems than their electricity consumption dictates, resulting in large volumes of excess PV generation being exported. This generally creates downsides for all parties, including the PV owner who may find their pay-back period is longer than a more modestly sized system and that their inverter trips off when exporting more often than it otherwise would.

Appendix 1

Network benefits of solar photovoltaic (PV) exports

Ergon Energy designs and constructs our networks to meet the highest or critical peak, forecast demand in coming years. The highest forecast demand occurs on 70% of Ergon Energy's feeders in the evening. As PV systems are not generating at that time, they deliver no network benefit on those feeders. Rather, the PV generation delivers downsides such as higher network voltages and poorer asset utilisation.

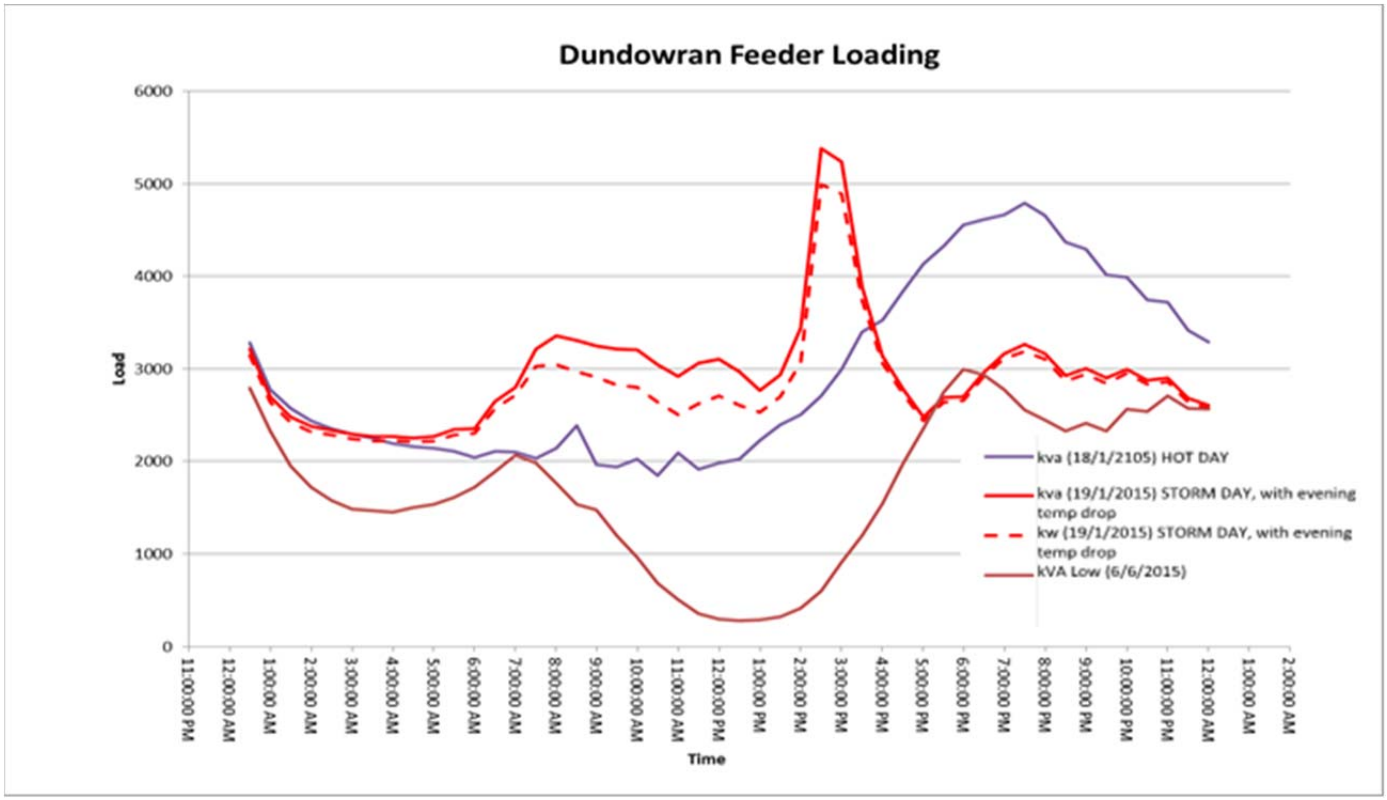
Around 30% of Ergon Energy's feeders have day-time peaks (that is, before 5pm) and PV generation can reduce those peaks, at times. Those feeders typically serve industrial estates, commercial centres and shopping centres. Roughly, 25% of those feeders experience their peak demand between 3 and 5pm, and 50% between 2 and 5pm, when PV generation is declining rapidly and the volume of exported electricity declines more rapidly. However, it is the very highest of those day-time peaks that determines the network capacity that must be ensured. Furthermore those peaks typically occur on hot days, when customers place comfort ahead of cost and environmental impact by running their air conditioners for longer periods and/or at lower temperatures. This can exacerbate the critical peak phenomenon which is further explained in Appendix 2.

In 2014, Ergon Energy identified two zone substations in South Mackay in which peak demand during weekdays, was growing and heading towards the maximum capacity. However, the networks were relatively underutilised at night and on weekends. Upgrading the substations and associated transformers and conductors was going to be significantly expensive. Ergon Energy launched a demand management initiative that, among other things, financially incentivised commercial customers to install PV systems above 10 kVA to reduce the day-time demand on the grid. The project only incentivised non-exporting systems as encouraging export may have created a new issue of high voltage, and commercial areas are not as prone to the third- or fourth-day peak as residential areas. While such initiatives show promise in terms of a network benefit of PV in a small number of specific circumstances, generally there is not sufficient evidence to show that exporting PV will defer upgrades as a result of the peak demand reduction created by exported electricity, or even PV more generally.

The intermittency of PV generation means network planners cannot rely on it to lower critical peaks. As a result, network capacity needs to be designed and constructed to the same level, whether there is high PV penetration or no PV at all.

Interaction of air conditioning and solar photovoltaic (PV) generation

Ergon Energy's network planners have identified an evolving phenomenon in the load profiles of many distribution feeders in the middle of some summery afternoons. It appears that in areas of high solar PV penetration, an increasing proportion of electricity demand during the day is being met with PV generation. However, this generation is doing little to reduce the peak, or even creating new network risks due to the intermittency of generation caused by cloud cover. For example, storm clouds rolling across the sky in the middle of the afternoon, significantly and suddenly reduce the output from PV systems, but the air conditioning load continues as the high temperature and humidity remain. The sudden loss in PV output must be responded to with a correspondingly quick increase in grid-supplied electricity, creating a spike in demand on the grid that can even exceed evening peaks. This phenomenon is well illustrated in this load profile (red line) from the Dundowran feeder in Hervey Bay.



Also illustrated in this graph is the growing issue of RPF, or looming RPF (maroon line). On a mild but clear sunny day in winter, for example, PV generation is relatively strong yet electricity use, especially by air conditioners, is low. The PV systems are generating and exporting almost all the electricity required on that feeder, with only a minimal volume being supplied through the local substation at the bottom of the trough (12 noon to 2.00pm).

If the volume of PV generation exceeds the demand on the feeder, RPFs occur, pushing back through the substation into the medium voltage network. This is not how the networks were designed to operate. While networks can largely cope with this new phenomenon, additional actions and investments must be taken by the distributors to minimise the adverse impacts.

Exacerbating this issue, the combination of network data and anecdotal insights suggest that many PV owners, even those on the 44 cents/kWh FIT rate, are more prepared than a customer without a PV system to use their air conditioners for longer periods and at lower temperatures, especially after a few hot days in a row. This is because those customers are somewhat comforted by the knowledge that their air conditioner is either being powered indirectly by the sun or at least their bills will be minimised by the benefits of their PV system – both grid supply offset and FIT credits.

These insights are assisting Ergon Energy to prepare for the network of the future and deliver engagement programs for our stakeholders and customers.

As previously stated however, there are also opportunities. With the rapid onset of technology development and deployment, including battery uptake, it is possible that solutions to recent emerging issues will be found to enable Ergon Energy's strategy to be an open access platform for technologies including renewables and provide network benefits including network stabilisation.

Ergon Energy is committed to being an active participant in initiatives including the roll out of solar and batteries to deliver a new energy future for Queensland.