Submission from

Climate Change Balmain-Rozelle[1]

on IPART's Issues Paper on

Solar feed-in tariffs in 2021-24[2]

Derek Bolton, 14/3/2021

Who we are and why we care

Climate Change Balmain-Rozelle Inc. was formed by a collection of residents in the Inner West of Sydney who came together out of mutual distress over Australia's excessive greenhouse gas emissions and the world our children will inherit.
Therefore we are keen to see the continued growth of renewable energy, including rooftop solar. However, this is under threat.

- Rooftop PV is a victim of own success. Spot prices are declining in the hours when PV generates. When the surplus PV power matches grid demand it will earn next to nothing, or worse.
- Excess total input is a problem for the grid
  - Drives voltage over the maximum allowed, sending spot prices negative
  - AEMC/AEMO's response will be to cap feed-in or even allow the tariff to be negative
- Excess local input overloads poles and wires
  - Feed-in may be locally capped

We appreciate that more solar cannot be the whole answer. Storage and Demand Response are needed the better to match demand. We offer the comments below in the hope of assisting the growth of both domestic solar and batteries to the benefit of all electricity consumers.

We count over 1000 supporters.

Part I. Questions regarding barriers to grid customers installing PV and/or battery

This part is essentially the presentation I gave in the first session of the virtual meeting on March 9.

"1. Is there enough information for customers to make the best financial decisions (given how much electricity they use and when they use it) on:

1. *whether to invest in solar systems?*
2. *the size of the system most suitable for them?*
3. *the retail offer they should choose?* "

There may be enough information, but perhaps not the tools by which to exploit it.

The Australian PV Institute's SunSPoT[3] is supported by many councils. The user can improve accuracy by supplying usage data and specific feed-in tariffs.

This still leaves the householder the task of calculating the financial benefit of a proposed installation for each of several offered retailer plans. This would be easier if retailers were to publish their tariffs on the net

1 http://www.climatechangebr.org/
2 https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/pricing-reviews-energy-services-publications-solar-feed-in-tariffs-202122/issues-paper-solar-feed-in-tariff-benchmarks-february-2021.pdf
3 https://apvi.org.au/sunspot/

in a standard form accessible by applications. It would then be possible for such a tool to scan retail plans and estimate the savings under each.

SunSPoT also handles solar+battery systems, but does not currently optimise battery operations in respect of time-of-use tariffs.

Recommendation:

- Engage in discussion with e.g. SunSPoT
- Specify standard form to retailers

"3. Are there any barriers to customers installing batteries? What options are available to customers?"

Evaluating the benefits of batteries is inherently more complex than merely adding PV. There is a four-way interaction between battery, PV, grid and demand.

Grid outage behaviours

Choosing among the grid-outage options for a grid-connected system is the first hurdle. In increasing order of upfront cost:

- *Basic*

  Grid outage disables battery and PV

- *Back-up*

  Manual switch-over to home power

- *UPS*

  Automatic switchover, providing continued power

Battery usage optimisation

If, at some instant, the PV system is not providing enough power to meet demand, is it better to draw on the battery or to use grid power, holding the battery in reserve for when the grid tariff is higher?

At least one smart system claims to handle this[4], presumably using the historic household demand profile.

Government or independent information on these topics is hard to find or nonexistent.

Part II. Questions on the calculation of feed-in tariffs

"4.1 What is the most suitable forecast of wholesale electricity prices?"

The current procedure is to predict average spot prices by discounting 5% from future contract prices.

The nature of rooftop PV as a generator into the grid lies somewhere between that of a conventional spot market participant and a contracted source. While a solar household has not entered into a contract to supply a specific energy profile, it is an obligate bidder: it effectively commits to supply whatever is available at the time. Taken as a whole, such a resource may prove relatively predictable.

In a given region, PV feed-in can be expected to have a certain average profile by time of day and day of year. The uncertainty is in how the actual supply may vary from that, principally in response to weather fluctuations.

The nature of the uncertainty for conventional power stations is different. An outage can take out many MW at a stroke, and, if a consequence of hot weather, several such stations may fail at once.

On price, that for household PV is knowable in advance, whereas a utility power station on the spot market may bid up either in response to fuel costs or simply to exploit a shortfall.

Recommendation*: Research is needed to determine whether the reliability comparison makes it appropriate to reduce the 5% discount from contract price forecasts.*

4 https://www.evergen.com.au/

"4.4 What time period should we use? "

The current procedure averages the future contract prices over the preceding 40 days.

On the basis that the relevance of historical data decays gradually, not suddenly after 40 days, a weighted average over a longer period would be appropriate; a negative exponential, perhaps.

E.g., if the price *N* days prior was p_N then weighting its value in proportion to 0.95^N would make the average age of the prices 20 days, as now.

Recommendation: IPART should review its past predictions against actual to see whether a negative exponential weighted average would have produced a more accurate forecast.

"5 How should we calculate the solar multiplier? "

The purpose of the solar multiplier is to arrive at a flat rate feed-in tariff which rewards the feed-in appropriately on average.

If the feed-in volume is f_i and the spot price is p_i in period *i* then the PV ought to earn $\Sigma f_i p_i$ over the day. At a flat rate of *R* it will earn $R\Sigma f_i$, therefore $$R=\frac{\sum f_i p_i}{\sum f_i}$$

It is unclear how this calculation will be affected by the growth of variable rate PV and battery feed-in. A feed-in source that earns more at peak periods will tend to feed in more at those times. If this is not discriminated from flat rate feed-in in the multiplier calculation it will tend to overvalue flat rate feed-in and undervalue the variable rate.

While that may provide a short term gain for existing flat rate feed-in, insufficient encouragement to match demand better will likely be detrimental to all in the longer term.

Recommendation: discriminate flat and variable rate feed-in volumes in the solar multiplier calculations.

"5.1 How should we model the solar multiplier? ", and *"5.2 How many years of historical data should we use? "*

There are several possible biases in the Monte Carlo method being used.

The method seeks to correlate spot prices with solar power output independently of weather conditions. But the correlation obtained may be weather dependent:

- On an overcast day in winter, solar output is low and prices high.
- On a hot summer afternoon, large power stations have a habit of failing, producing high prices while solar output is high.

As a result, the calulated correlation depends on the weather pattern experienced in those years.

There are also conflicting pressures regarding the range of years to use. Too few years will not reflect the variability in weather conditions, while too long a history underestimates the impact of solar on prices.

In practice, a year, or even a sequence of three years, may be dominated by a particular state of ENSO[5].

The Monte Carlo method itself can lead to bias in the distribution of solar multipliers:

1. Multiple independent selections of days from a given quarter and day of week mean that a bout of weather covering a sequence of days in one year may by chance be over- or under-represented. This will tend to flatten the distribution, i.e. raise the odds of outliers.
2. Conversely, selecting consecutive days independently from several years will smooth out outliers, narrowing the curve.

It is unclear which effect would dominate.

Recommendation:

5 https://www.climate.gov/news-features/blogs/enso/what-el-ni%C3%B1o%E2%80%93southern-oscillation-enso-nutshell

- With the possible assistance of BoM, construct a dataset representing many years' worth of weather.
  - For each time of year and time of day, the dataset records a probability distribution of conditions, such as temperature and solar irradiation.
  - It may be appropriate to discriminate weekends, as these do have slightly different weather patterns.
  - The records should also discriminate states of ENSO.

  All up, about one million numbers.
- Use recent historical data to establish the correlations between weather conditions, day of week, time of day, spot prices and PV output.
- For the period to be forecast, use BoM's predicted ENSO state.
- Instead of generating thousands of random years, a single pass through the dataset can calculate the probability distribution of prices and PV output for each half hour, and accumulate those into means and variances.

A benefit of this approach is that many years can be used for creating the dataset, and it only need be updated every few years. More timely data would be used for the weather's correlation with price and PV output.

"6 How should we set the ranges around the benchmarks? "

Recommendation: Using the historical ratio of forecast spot prices to actual spot prices, set the range one standard deviation either side, and document that relationship.

"7 How should we set benchmarks for different times of the day? "

Item:

> *"Even though solar exports are very low after 5 pm, we set benchmarks in the later afternoon and evening because wholesale prices were highest at this time "*

Recommendation:

This is useful because it makes more westerly facing panels cost-effective, encouraging such deployments and helping to cut peak loads on the grid.

Item:

> *"After 6 pm, electricity values are not weighted by solar output, because solar exports are negligible during these times "*

Recommendation:

That is fine for setting flat rate FiT ranges from historical data, but, for variable rate, batteries may well export at that time. To anticipate the adoption of batteries, the variable FiT benchmarks should cover 24 hours, perhaps in half hour periods.

For the flat rate tariff, the saving on poles and wires is rewarded by adding the NEM fees avoided by the retailer. But retailers pay a lot for their peak load on the grid. For a variable FiT, this should be reflected in the various periods. It is unclear whether this has been considered in developing these ranges.

Another option may be to publish an algorithm by which the retailer can compute the FiT range for each period from what that retailer charges for that period.

Item:

> *"retailers may continue to prefer to set an all-day rate, reflecting the small amount of variation in the value of the vast majority of solar exports."*

Recommendation:

This should be discouraged. It will not suitably reward battery feed-in, and is self-fulfilling for PV: while there is no elevated rate for late afternoon, there is no incentive to instal more westerly-facing panels.

For example, a model based on the months of January 2015 and 2016 shows that a panel in Sydney oriented 30° W, elevation 80°, would have earnt 10% more on spot prices than one at the standard North facing, 34° elevation. Of course, it needs to be optimised on a model that runs the whole year.

It is understandable that retailers are comfortable with the *status quo* since they effectively operate on a cost-plus basis, but this is a barrier to optimising the battery-PV-grid interaction.

Item:

Some consumer groups are also concerned that variable rate tariffs, whether for usage or feed-in, are hard for customers to understand. But we need such arrangements to become common for the benefit of all consumers.

It is hard to see how PV or battery leasing schemes, wherein a third party deals with the complexities and exposes a simpler interface to the householder, can help. The third party would need some surety that the household demand profile stays within expectations.

Recommendation:

Part of the problem is a lack of independent expert advice.

- Government websites could discuss the options and provide examples.
- Local councils could make expert advice available.

Part III. Future evolution

"8 Have there been any changes to the market design that affect the value of solar exports? "

Item:

> *"The renewables industry is concerned that Distribution Network Service Providers (DNSPs) will increasingly impose 'zero export' requirements on new solar customers connecting in areas already congested. Technical issues will increasingly act as a handbrake on the decarbonisation of the energy system."*

That is a natural consequence of the free market, but the outcome can be improved by ensuring that tariffs, both in and out of the grid, are cost-reflective. That will encourage:

- solar installations designed for better performance in morning and evening peaks,
- solar generation close to industries and offices
- domestic and community batteries in grid-constrained regions,
- daytime EV charging

Item:

> *"Vulnerable customers are concerned about the increasing cross-subsidies from customers who do not have DER, and may never be able to, to those who do."*

There is no inherent reason why that should be the case. DER is an overall good. It should be possible to reward both those who engage with DER and, to a lesser extent, those who do not.

Item:

> *"the rule change requests include removing prohibiting system charges for export services into the distribution network."*

Recommendation:

The solution, which we believe is being considered by AEMO, is to make household PV and battery systems respond to grid signals. Ideally, these would throttle back feed-in progressively rather than being a simple on/off. The sooner new systems are required to support such a signal the better, but in fairness it should also be retrofitted over time.

Item:

> *"One of the proponents ... proposes that any future tariffs applied to exports would principally seek to recover incremental costs of providing export capacity*

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For example, customers could choose from:

- a 'basic' service at low or zero cost that is reflective of low export capacity aligned to the intrinsic hosting capacity of the network, or

- a 'premium' service, such as higher than average export capacity, without the associated costs being apportioned to customers that do not want such services."

A grid region with low export capacity is problematic both for the would-be exporter and the potential importers who might gain from a cheaper power source. Yet this proposal puts all the cost on the would-be exporter.
Moreover, the cost is borne by those exporting while the grid is still constrained, but after the upgrade others may export more freely.
Thus, such a scheme may delay a mutually beneficial development.

Recommendation:

It would be fairer and more constructive that the DNSP bear the cost of the upgrade, then be allowed to recoup the cost over time from all parties. This may require rule changes.

Part IV. Asides on matters that may be beyond IPART's remit

On time-of-use charging and connection charges for households

Various trends are increasing the peak-to-average demand ratio:

- grid-connected PV (whether fed-in or self-consumed),
- air conditioning in late afternoon/early evening
- high gas prices leading to a shift to electric cooking

The roll-out of EVs will add to this if they are recharged on returning home at day's end.

At present, much of the poles and wires cost is bundled into the per-unit charges, whether flat rate or time-of-use. This can be justified on the basis that low-usage households tend to be economically disadvantaged, making such a cross-subsidy appropriate.

Since the above trends correlate with higher income households, and the grid is built to meet peak demand, these charging arrangements are subsidising some of those too. This is in danger of becoming unsustainable.

A possible way forward is:

- Roll out smart meters to all households
- Make all tariffs time-of-use, but by an algorithm that depends on profile; e.g. if the usage at peak time is below a threshold then it turns into flat rate, (but quite likely a bit cheaper than now).
- For that higher peak use, bundle less of the connection cost into the per-unit price.

On 'plans'

It is galling as a customer to have to choose among a raft of plans from a retailer in advance. The retailer enjoys a windfall if the customer misguesses future use or miscalculates the total cost. This is economically regressive in that it penalises those less numerate.

It would be reasonable to require the retailer to select the least cost of its advertised plans at the end of the billing period, based on actual usage.

The customer would still need to choose a retailer based on the advertised ranges.

On the public perception of how PV households affect others

Some sections of the media have spread the view that PV households are effectively subsidised by other customers. IPART is well aware that the gowth of rooftop PV has pushed down peak demand and consequently reduced both peak generation costs and peak transmission and distribution costs, holding power prices down for all.

While we understand that IPART does not factor this historic achievement into the FiT range, we would encourage IPART to find ways to correct the public misperception. If nothing else, it would raise the standing of IPART in the PV household community.

Glossary

Acronym	Expansion	Description
AEMC[6]	Australian Energy Market Commission	The rule maker for Australian electricity and gas markets
AEMO[7]	Australian Energy Market Operator	The manager of the electricity and gas systems and markets
BoM[8]	Bureau of Meteorolgy	
DER	Distributed Energy Resource	Rooftop solar, domestic batteries
DNSP	Distribution Network Service Provider	
ENSO[9]	El Niño-Southern Oscillation	The range of states of the sea surface temperature distribution in the equatorial Pacific
FiT	Feed in Tariff	
NEM[10]	National Electricity Market	Wholesale market operated by AEMO across ACT, Qld, NSW, Vic, Tas, SA

6 https://www.aemc.gov.au/
7 https://www.aemo.com.au/
8 http://www.bom.gov.au/
9 https://www.climate.gov/news-features/blogs/enso/what-el-ni%C3%B1o%E2%80%93southern-oscillation-enso-nutshell
10 https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem