

Independent Pricing and Regulatory Tribunal  
New South Wales

## Solar feed-in tariffs

**The value of electricity from small-scale solar panels in  
2018-19**

Draft Report  
Electricity

May 2018

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## Invitation for submissions

IPART invites written comment on this document and encourages all interested parties to provide submissions addressing the matters discussed.

### **Submissions are due by 4 June 2018**

We would prefer to receive them electronically via our online submission form <[www.ipart.nsw.gov.au/Home/Consumer\\_Information/Lodge\\_a\\_submission](http://www.ipart.nsw.gov.au/Home/Consumer_Information/Lodge_a_submission)>.

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**Solar feed-in tariff benchmarks**

Independent Pricing and Regulatory Tribunal

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# 1 Executive summary

In NSW more than 10% of households and small business premises have installed a solar photovoltaic (PV) system, or solar panels.<sup>1</sup> When these solar customers use electricity generated by their solar panels rather than buying it from their retailer, they can make significant savings on electricity bills. When they don't use all the electricity they generate themselves, the excess amounts are exported to the grid, and they may be paid a 'solar feed-in tariff' for these solar exports.

Retailers aren't obliged to offer solar customers a solar feed-in tariff for their solar exports. Rather, they can choose to do so in their market offers to solar customers. And if they do, they set this tariff themselves. Currently, most retailers do offer solar customers a solar feed-in tariff of between 6 cents and 20 cents per kilowatt hour (c/kWh).

To help retailers in setting their solar feed-in tariffs and solar customers in deciding whether these tariffs are reasonable, the Independent Pricing and Regulatory Tribunal of NSW (IPART) has set a 'benchmark range' for solar feed-in tariffs for each year since 2012. Our benchmarks provide guidance on the financial value of electricity exported by solar customers in NSW in the coming financial year.

The NSW Government has asked IPART to continue setting benchmarks for solar feed-in tariffs annually for the next three financial years, from 2018-19 to 2020-21 (our Terms of Reference are provided in Appendix A).<sup>2</sup> We have also been asked to set time-dependent benchmark ranges for solar feed-in tariffs.

This report outlines our draft decisions on benchmarks for solar feed-in tariffs for 2018-19, and explains why and how we reached these decisions, including our responses to stakeholder comments on our Issues Paper. We invite all interested parties to comment on this Draft Report (see Section 1.7 for more information).

## 1.1 Our draft benchmark for all-day solar feed-in tariffs is 7.5 c/kWh

To set our benchmarks for solar feed-in tariffs, we forecast what retailers would pay for customers' solar exports if this electricity were sold into the wholesale spot market (the National Electricity Market or NEM) in the same way as other generators' output.<sup>3</sup> In this market, wholesale prices are set for each half hour of the day to reflect the supply and demand for electricity at that time.

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<sup>1</sup> Department of Planning and Environment, *Solar Panels and Systems*, <https://www.resourcesandelectricity.nsw.gov.au/electricity-consumers/solar/solar-panels>, accessed 14 February 2018. AER, *NSW – Small Customers*, <https://www.aer.gov.au/retail-markets/retail-statistics/nsw-small-customers>, accessed 14 February 2018.

<sup>2</sup> We have been asked to conduct this review under Section 9 of the IPART Act.

<sup>3</sup> This is a hypothetical concept, as customers with small-scale solar PV cannot sell their exported energy into the wholesale spot market.

Typically, these wholesale prices are:

- ▼ lower late at night (when demand is lowest), and through the middle of the day (when solar energy meets a proportion of demand), and
- ▼ highest in the late afternoon and evening (when demand is highest as people return home from work, and when solar energy meets little or none of this demand as the sun sets).

We set the draft benchmark for the all-day solar feed-in tariffs based on our forecast of the **average price** that retailers would pay for solar exports across the day (weighted by solar output) if they were buying them on the wholesale market.

For 2018-19, our draft all-day benchmark is **7.5 c/kWh**.

We consider this benchmark is reasonable, and that setting a higher benchmark would lead to unacceptable outcomes. In particular, if retailers were required to pay more for these solar exports than they would pay for wholesale electricity on the NEM, retail prices for all customers would need to be higher to recover the difference. While some retailers choose to offer feed-in tariffs that are higher than our benchmarks, we estimate that:

- ▼ If **all** retailers paid a solar feed-in tariff of 15 c/kWh in 2018-19 (or double the forecast average wholesale value of solar), their total costs would be \$59 million higher across NSW, compared to paying an average feed-in tariff of 7.5 c/kWh in line with our all-day benchmark. To recover these additional costs from NSW households, the average annual household bill would need to increase by around \$22.
- ▼ If all retailers paid a feed-in tariff of 25 c/kWh (17.5 c/kWh above the forecast average wholesale price and equal to the current average retail price of electricity), their total costs would be \$137 million higher, and the average annual household bill would need to increase by around \$50.<sup>4</sup>

In effect, a higher feed-in tariff would result in households **without** solar panels paying higher electricity bills so that customers **with** solar could receive more for their solar exports. This would be contrary to the requirement in our Terms of Reference from the Government that our benchmark range not lead to higher retail prices. It would also disproportionately affect the households who are unable to install a solar system themselves (for example, because they rent or they cannot afford the upfront costs).

All electricity customers are already paying an average of around \$15 per year to customers with solar panels to subsidise the upfront installation costs under the Small-Scale Renewable Energy Scheme, as well as an average of \$55 per year for other 'green costs' (including subsidies for the Renewable Energy Target, the climate change fund, and the Energy Saving Scheme).

Currently, average annual bills for solar customers are an average of \$450 lower than customers without solar panels, **before** revenue earned from solar feed-in tariffs (see Box 1.1). This represents an ongoing saving to customers after their payback period (which is currently approximately 6-8 years).

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<sup>4</sup> See footnote 14 for information on our estimation methodology.

### Box 1.1 Bills for households with solar panels are significantly lower

The average household bill for a solar customer with a 2-kW system is around \$1,550 per annum, compared to \$2,100 for households without panels. Solar customers can save around \$450 a year by using the solar energy they generate themselves (rather than purchasing it from their retailer), in addition to receiving any solar feed-in tariff from their retailer (an average of around \$100).

Solar customers also receive an upfront subsidy for installing their panels under the Small-Scale Renewable Energy Scheme. For a 2-kilowatt solar system installed in Sydney, the subsidy is currently worth around \$1,050 to \$1,330. After this subsidy, the upfront costs of a solar system are around \$3,400. The payback period for these upfront costs is around 6 years.

Following the payback period, the customer is able to make ongoing savings off their bills for the remaining life of the panels (around 19 years).

Even without any feed-in tariff, this customer would still pay off their panels in around 7.5 years. Similarly, if the upfront subsidy were removed, the payback period would be 8 years, with a remaining life after payback of almost 17 years.

**Note:** The values for financial incentives under the SRES assume the solar unit is installed in Sydney on 24 April 2018. The dollar range is based on certificate prices of \$30 and \$38. Assumes a solar panel life of 25 years.

**Source:** Clean Energy Regulator, *Small generation unit STC calculator*, <https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator>, accessed 24 April 2018; Green Energy Markets, *STC Market Prices*, <http://greenmarkets.com.au/resources/stc-market-prices>, accessed 24 April 2018. Solar Choice, *Current Solar System Prices: Residential and Commercial*, <https://www.solarchoice.net.au/blog/solar-power-system-prices>, accessed 24 April 2018.

## 1.2 Our draft benchmark is lower than the current benchmark because the forecast wholesale value of solar exports in 2018-19 is lower

To estimate the value of solar exports for the coming financial year, we estimate the average wholesale electricity price based on the NSW future contracts, and then apply a 'solar multiplier'. This multiplier takes account of whether wholesale prices are likely to be higher or lower than average at the times when solar customers export to the grid (that is, weighting wholesale prices by solar output):

- ▼ If more solar exports occur during times when spot wholesale prices are higher than average, the solar multiplier will be greater than one.
- ▼ If more exports occur when spot wholesale prices are lower than average, then it will be less than one.

We calculate the solar multiplier using historical data on the average wholesale price across the day and the times when solar customers export to the grid.

For 2018-19, our draft benchmark for all-day solar feed-in tariffs of 7.5 c/kWh is lower than our current all-day benchmark of 12.8 c/kWh for 2017-18. This is because both the average forward price and the solar multiplier for 2018-19 are lower than for 2017-18.

As Table 1.1 shows, the Australian Stock Exchange (ASX) baseload electricity contract prices are around 7.4 c/kWh for 2018-19, which have fallen from 11 c/kWh for 2017-18 (when we published our Final Report last year).<sup>5</sup>

<sup>5</sup> ASX baseload electricity contract prices are less the assumed 5% contract premium.

The reduction in the ASX forward contract prices is consistent with the forecasts in the Australian Energy Market Commission's (AEMC) 2017 Residential Electricity Price Trends report:

The trend in wholesale costs in 2018/19 and 2019/20 is downwards and is driven by:

- approximately 4,100 MW of new committed and expected (modelled) generation entering the NEM in 2018/19 and 2019/20.
- the return to service of the Swanbank E gas power station (385 MW) in early 2018
- reduced short-run costs for South Australian gas plants in 2019/20 due to the pass through of certificate revenue related to the Energy Security Target.<sup>6</sup>

In addition, the most recent historical data suggests that wholesale prices are likely to be lower at the times of the day when solar is exported to the grid than they were in previous years. In our 2017-18 review, we estimated a solar multiplier of 1.14 (based on seven years of data from 2009-10 to 2015-16), which meant that the value of solar exports would be 14% higher than the average wholesale price across the day. This reflected historical spikes in wholesale prices in the middle of the day.

However, since 2011-12, wholesale prices have trended lower in the middle of the day as solar generation has increased and met a greater proportion of demand at this time. Therefore, we have calculated the solar multiplier for our 2018-19 draft benchmarks based on the most recent three years of data (to 2016-17) to best reflect supply and demand conditions for the forecast year. Using this data, we have calculated a solar multiplier of 0.99, which means we expect the value of solar exports will be slightly lower than the average wholesale price of energy across the day (a solar multiplier of 1 would indicate that the value of solar exports is equal to the average wholesale price of energy).<sup>7</sup>

As part of our methodology to calculate the value of solar exports, we also:

- ▼ multiply the value of the solar energy by a loss factor<sup>8</sup>, to gross up solar generation to account for the avoided losses that usually arise as electricity flows through the transmission and distribution networks because solar exports tend to be consumed close to where the electricity is produced, and
- ▼ add the value of the NEM fees and charges that are avoided because these charges are levied on retailers' net purchases.

These components account for a relatively small fraction of our benchmark (less than 0.2 cents).

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<sup>6</sup> AEMC, 2017 Residential electricity price trends Final report, December 2017, p 19.

<sup>7</sup> For this review, we used only the most recent three years of historical data to estimate the solar multiplier, whereas in previous years we used data from each year from 2009-10. The reasons for this change in our methodology are explained in Chapter 6.

<sup>8</sup> We use a weighted average loss factor across the three distribution network areas in NSW, accounting for both transmission and distribution line losses. Our Draft Report uses 2018-19 estimates based on loss factors for 2017-18, which will be updated for the Final Report.

**Table 1.1 Draft benchmark components for all-day solar feed-in tariffs in 2018-19 compared to 2017-18**

	2017-18 (final)	2018-19 (draft)
<b>Average forward price (ASX baseload price)</b>	11.0 c/kWh	7.4 c/kWh
<b>Solar multiplier</b>	1.14	0.99
<b>Network loss factor</b>	1.01	1.01
<b>NEM fees and charges</b>	0.08 c/kWh	0.08 c/kWh

**Note:** The all-day feed-in tariff is calculated according to the following formula:

*(Average forward price x solar multiplier x network loss factor) + NEM fees and charges.*

2018-19 estimates based on loss factors for 2017-18, and projected NEM fees and charges for 2018-19. These will be updated for the Final Report.

### **1.3 We have not proposed a range for the all-day tariff benchmark as we expect little variation in the value of solar exports across the day**

In previous years, we have set a benchmark range based on the value of solar at different times of the day. We set the top of the range based on the two-hour window when the value of solar exports was forecast to be highest (this was between 2 pm and 4 pm in 2017-18), and the bottom of the range based on the value of exports at all other times.

However, in 2018-19, the wholesale value of solar is highest after 5:30 pm when less than 1% of solar exports occur. Because such a small amount of solar generation occurs in this time window, we considered that setting the top of the range in line with the value of solar at this time in the same way as we have done in previous years would not provide a realistic guide to customers about the value of solar for the overwhelming majority of their exports.

Our forecasts for 2018-19 indicate that the value of solar exports will hardly vary across the times of the day when most solar exports occur. In particular between 6:30 am and 3:30 pm, when 90% of all solar exports occur, there is very little variation. As a result, we have made a draft decision to set a single 'all-day' benchmark for this review. This single benchmark also provides a more useful comparator for the offers that are currently available in the market, which provide only one feed-in rate regardless of the time that solar exports into the market.

### **1.4 We have proposed benchmark ranges for time-dependent solar feed-in tariffs**

As noted above, for this review, the Government has asked us to also set a benchmark range for time-dependent solar feed-in tariffs (ie, to guide retailers in setting a tariff that varies depending on the time of day the solar customer exports to the grid). Retailers could offer different feed-in tariffs across the day as an alternative to an all-day rate (however, currently retailers are choosing to offer their customers a single feed-in tariff that applies at all times).

Our draft decision on the benchmark ranges for these tariffs are shown in Table 1.2. We have set these ranges based on when the most price variation occurs during the day.

**Table 1.2 Draft benchmark ranges for time-dependent solar feed-in tariffs**

Time window	2018-19 (c/kWh)	Proportion of solar exports
6:30 am to 3:30 pm	6.9 – 7.2	90.8%
3:30 pm – 4:30 pm	8.9 – 11.7	5.8%
4:30 pm – 5:30 pm	11.3 – 13.3	2.6%
5:30 pm – 6:30 pm	12.8 – 20.9	0.72%
6:30 pm – 7:30 pm	8.7 – 9.6	0.07%
7:30 pm – 8:30 pm	8.4 – 8.5	0.002%

Table 1.2 shows that the average value of solar is higher in the afternoon. This means it would be more cost-reflective if retailers offered a higher feed-in tariff in the afternoon, compared to the morning rate. If this were the case, some customers might respond by supplying a greater proportion of their exports to the market during the afternoon (for example, they may choose to install panels that face more towards the west instead of north). Supplying more energy to the grid when it is most needed could help drive market-wide efficiencies by putting downward pressure on wholesale prices at these times.

Even though solar exports are very low after 5:30 pm, we set separate benchmarks in the later afternoon and evening because wholesale prices are highest at this time. Currently, customers have a limited ability to respond to a high feed-in tariff in the very late afternoon because there is limited sunlight at this time. However, these benchmarks provide a price signal to customers with batteries, or considering purchasing batteries, about when they should export their energy to the grid. Only around 1,600 households in NSW currently have batteries, representing less than 0.1% of households.<sup>9</sup> But over time this signal will become more important, as battery prices fall and their uptake increases.

The peak prices in the late afternoon and evening are being driven by high levels of electricity demand at the same time of the day as solar output is falling. Higher wholesale prices in the evening also reflect increasing ‘peakiness’ of wholesale prices in recent years, as the demand-supply balance has tightened, particularly following the closure of Hazelwood in Victoria in March 2017. This means that prices are often driven by higher cost generation (such as gas generators) when demand is highest.

In setting the benchmarks, we:

- ▼ Set one benchmark between 6:30 am and 3:30 pm, because there is very little variation in wholesale prices across these times.
- ▼ Set benchmarks for each **one-hour** period after 3:30 pm, when there is much more price variation.
- ▼ Set benchmarks after 6:30 pm that are not weighted by solar output. Solar exports are negligible during these times, so the main reason for setting these benchmarks is to provide a price signal for the value of battery exports.

We note that while the time-dependent feed-in tariffs are likely to be more cost-reflective, 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. Retailers submitted that a single

<sup>9</sup> Australian Energy Council, Solar Report – January 2018, p 6.

all-day solar feed-in tariff is simple to understand and does not create complexity and additional costs to retail operations.<sup>10</sup>

## 1.5 We considered stakeholder comments and do not agree that solar feed-in tariffs should be higher

Around 410 stakeholders made a submission in response to our Issues Paper. Many of these stakeholders submitted that solar feed-in tariffs should be higher than our preliminary estimate of 8.3 cents per kWh. Our draft benchmark for all-day solar feed-in tariffs is lower than this, at 7.5 c/kWh, because it reflects the most recent forward contract wholesale price from the ASX, which has fallen from 8 cents to 7.4 cents (less the contract premium) since we released our Issues Paper.

Most of the issues that were raised in submissions have also been raised in previous reviews. The most common themes in submissions were:

- ▼ feed-in tariffs should include a subsidy to reflect the value of the environmental and health benefits that solar electricity provides to the broader community,
- ▼ feed-in tariffs should be the same as retail prices or retailers will profit unfairly from solar customers,
- ▼ reducing the solar feed-in tariff benchmark in line with wholesale costs would be effectively punishing solar panel owners for their contribution in helping to reduce the wholesale power price for all consumers, and
- ▼ feed-in tariffs should also reflect the financial benefit to electricity network suppliers, particularly the potential to defer network investment.

In general, if we were to set the benchmark for solar feed-in tariffs higher than the financial value of customers' solar exports to retailers (ie, the cost they avoid when they supply this electricity to other customers rather than purchasing an equivalent amount on the NEM), retailers would likely set the feed-in tariffs they offer below this benchmark.

Even if retailers were **required** to offer a minimum feed-in tariff equal to our benchmark, we consider this benchmark should not exceed the financial value of solar exports to retailers because this would result in:

- ▼ higher costs to retailers, which they would then need to recover from all customers, or
- ▼ retailers choosing not to supply solar customers, which would reduce competition for solar customers.

As outlined in Section 1.1, our view is that households without solar panels should not have to pay higher retail prices to reduce the bills of customers with solar panels. This would disproportionately affect the households who are unable to install a solar system themselves (for example, because they rent or they cannot afford the upfront costs).

Our specific responses to the common themes raised by stakeholders are set out below.

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<sup>10</sup> AGL submission to IPART Issues Paper, April 2018, p 2.

### 1.5.1 Customers already receive a subsidy when they install a solar system

Some stakeholders submitted that solar feed-in tariffs should include a subsidy to reflect environmental and health benefits that solar electricity provides to the broader community. However, solar customers already receive a subsidy designed to take account of benefits of solar to the broader community. This is the subsidy provided by the Australian Government's Small-Scale Renewable Energy Scheme (SRES) when they install a solar system.<sup>11</sup> This subsidy reduces the upfront costs of a solar system. The amount of the subsidy is based on geographical location, installation date, and the amount of electricity the system will generate or displace over its lifetime. For a 2-kilowatt solar system installed in Sydney, the subsidy is currently worth around \$1,050 to \$1,330.<sup>12</sup> On average, all NSW households pay around \$15 each year through their bills to fund the Small-Scale Renewable Energy Scheme subsidy.<sup>13</sup>

In addition, retailers don't capture the environmental or health benefits associated with solar energy. This means that if a value for these benefits were included in feed-in tariffs, retailers would need to recoup this amount from all their customers through higher retail prices.

### 1.5.2 Retailers would make a loss if feed-in tariffs were equal to retail prices

Numerous stakeholders submitted that retailers are unfairly profiting from solar customers because they offer feed-in tariffs that are much lower than their retail charges, and that feed-in tariffs should be the same as retail prices ('1-for-1'). These stakeholders considered that retailers can sell the solar electricity exported by their customers to other customers at little or no cost on top of any feed-in tariffs they pay. But this is not true.

The metering and settlement arrangements in the NEM mean that retailers incur network and green scheme costs for every kWh of electricity they supply to a customer, **regardless of where and how the electricity was generated**. Therefore, retailers still pay these costs when they supply electricity from solar exports (Figure 1.1).

If retailers were required to pay 1-for-1 solar feed-in tariffs, they would make a substantial loss on solar customers. Therefore, they would most likely choose not to supply solar customers. Alternatively, they would increase their retail prices to recoup this loss. We

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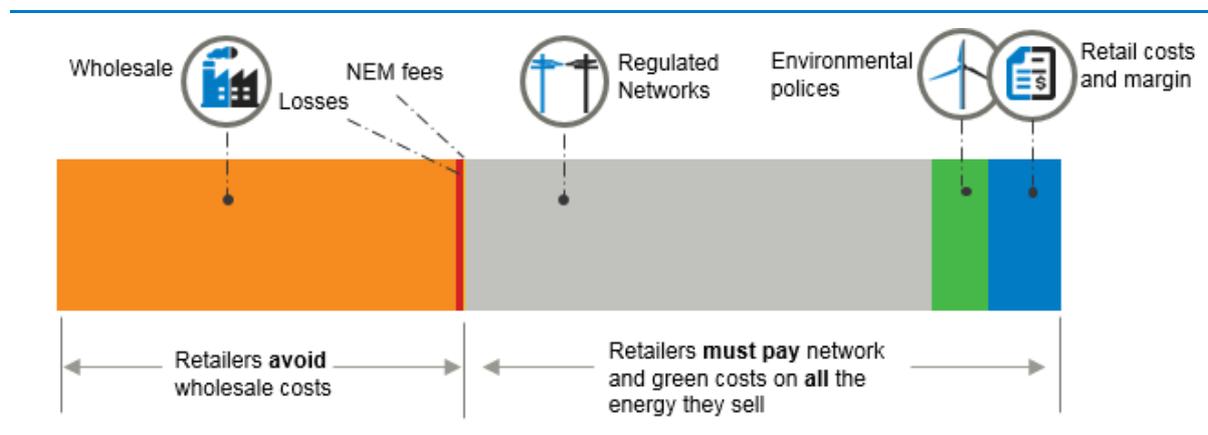
<sup>11</sup> Under the Small-Scale Renewable Energy Scheme, electricity retailers are required to purchase certificates based on the volume of electricity they acquire each year. Retailers' costs are recovered through their retail electricity prices. See <http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Renewable-Energy-Target-liable-entities>, accessed 3 May 2018.

<sup>12</sup> The estimated subsidy is based on a solar unit installed in Sydney on 24 April 2018. The price of certificates (STCs) is assumed to be between \$30 and \$38 and the number of eligible certificates is based on the Clean Energy Regulator's Small generation unit STC calculator, <https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator>, accessed 24 April 2018.

<sup>13</sup> AEMC, *2017 Residential Electricity Price Trends*, Final Report, 18 December 2017, p 100.

estimate that for 2018-19, this loss would be around \$137 million per year state-wide, which would add around \$50 to the average annual household bill in NSW.<sup>14</sup>

**Figure 1.1 Cost components recovered in retail electricity prices**



**Note:** Based on a representative market offer.

**Data source:** AEMC, *2017 Residential Electricity Price Trends*, Final Report, 18 December 2017, p 100.

### 1.5.3 Customers should be paid the market value for the electricity they generate

As discussed in the sections above, we have found that solar generation has reduced demand for electricity from retailers during daylight hours, which has contributed to lower prices during these times. Many stakeholders argued that reducing the solar feed-in tariff benchmark in line with wholesale costs would be effectively punishing solar panel owners for their contribution in helping to reduce the wholesale power price for all consumers. Similarly, the argument was put that because solar exports have contributed to the lower wholesale prices upon which our solar feed-in benchmark calculation is based, that solar customers should receive some of this benefit.

However, any new generator (or new customer) entering or exiting the electricity market would change the balance of supply and demand, and thus could lead to lower or higher wholesale electricity prices. Such a generator (or customer) would not be compensated for this impact. For example, a new generator that contributes to a reduction in wholesale spot prices does not receive any additional payment to reflect the lower wholesale price. It takes the same market price as all other generators, and so all customers benefit from the price reduction. Likewise, a customer who consumes electricity by switching on an appliance and thereby increasing the market demand for electricity and electricity prices for all customers is not required to compensate the other customers for these higher prices. These are normal outcomes of a competitive market.

<sup>14</sup> Based on total estimated solar exports, and forecast number of households in NSW, using data from networks on solar exports and number of solar customers, and data from ABS 2016 Census data and New South Wales Department of Environment and Planning for forecast of number of households (4% growth assumed since 2016 based on average annual growth 2016-2021). See ABS, '2016 New South Wales (STE) Community Profile', cat. No 2001.0, Table G32, <http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20Census%20Community%20Profiles>; <http://www.planning.nsw.gov.au/Research-and-Demography/Demography/Population-projections>. Estimates may understate the total annual solar output, as no growth factor has been applied to latest available customer numbers for 2018-19. This would result in an underestimate of additional costs to retailers and customers.

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In our view, solar customers should be treated like any other generator in the competitive electricity market.

#### **1.5.4 Solar exports are *not* likely to provide system-wide net benefits for networks**

Some stakeholders called for feed-in tariffs to include a value for the benefit that solar provides to the electricity network, particularly the potential to defer investment in the networks.

Because retailers do not capture any value associated with benefits to the networks, our view is that such a payment would need to be made from the networks (rather than retailers) to customers.

However, when this issue was considered by the AEMC in 2016, it decided not to introduce a payment from networks to customers because it found that even in areas where there was projected network congestion, payments to embedded generators (like solar) can increase costs to consumers while offering little or no deferral of network investment. The analysis showed that any benefit from additional embedded generation as a result of introducing a network credit scheme would be far outweighed by the costs of the scheme.<sup>15</sup> The analysis also showed solar combined with batteries had a limited additional effect on deferring network investment, and that the benefit is still outweighed by the cost.<sup>16</sup>

This is consistent with our analysis. We have found that solar exports are unlikely to contribute to meeting peak demand on the distribution and transmission networks (because the peak occurs in the late afternoon when the proportion of exports is very low), and therefore are unlikely to defer network costs. Solar exports may impose costs on the distribution network. For example, investments may be needed to support bi-directional flows of electricity to handle the volume of solar exports.

#### **1.6 We have found offers with higher feed-in tariffs are unlikely to result in cheaper bills overall for solar customers**

Our analysis shows that offers with higher feed-in tariffs do not necessarily result in lower bills. As most solar customers import much more electricity than they export, the most important thing they should consider when comparing market offers is the retail electricity price they will be charged. This price typically includes per kilowatt hour (kWh) usage charges, and a fixed daily supply charge ranging from 80 cents to \$1.50 per day. Other important factors are the terms and conditions associated with the offer, such as any contract period, fees such as exit fees, and late payment fees.

Figure 1.2 compares the annual bills for all solar offers that are currently available in the Ausgrid network area. We calculated the bills for a solar customer with a 2 kW system (around 8 panels), assuming they used the average amount of electricity (6,500 kWh), and used two-thirds of it in their home.

It shows that there is not a strong correlation between customers' total bills and the feed-in tariff offered. For many offers, a customer is better off overall with a lower-feed-in tariff

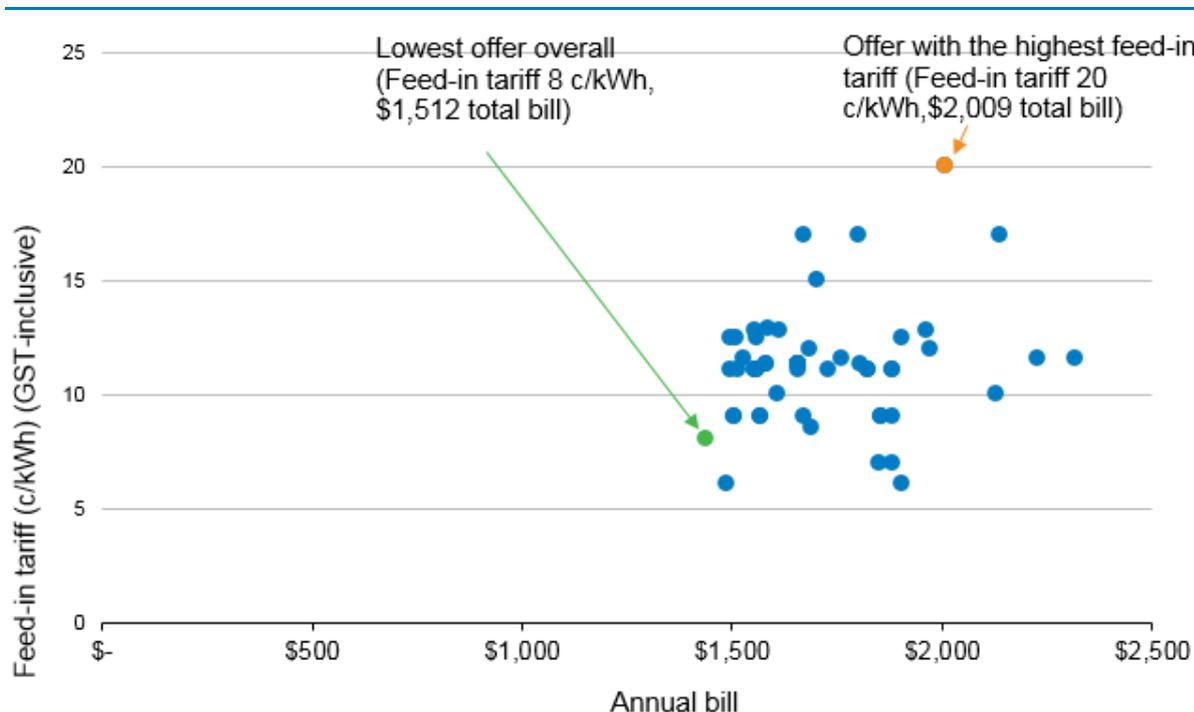
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<sup>15</sup> AEMC, *Local Generation Network Credits, Final Rule Determination*, December 2016, pp vi-vii.

<sup>16</sup> AEMC, *Local Generation Network Credits, Final Rule Determination*, December 2016, pp vi-vii, 34.

(because the retail tariffs offered by retailers are also lower). Of the offers in the market that resulted in the highest bills, some had relatively high feed-in tariffs, and others had relatively low feed-in tariffs.

**Figure 1.2 Annual bills and feed-in tariffs (April 2018, Ausgrid network area)**



**Note:** in this example, the 2 kW solar system generates 2,546 kWh per year.

**Data source:** IPART

Customers need to look at all elements of a retailer’s offer in deciding whether to accept an offer, rather than focussing on the feed-in tariff. We encourage all customers, including solar customers, to regularly shop around for a better deal. The Australian Government’s Energy Made Easy website ([www.energymadeeasy.gov.au](http://www.energymadeeasy.gov.au)) provides information about the offers that are available. Customers can use the tool provided on the IPART website ([www.ipart.nsw.gov.au](http://www.ipart.nsw.gov.au)) to help compare these offers based on how much solar energy they are likely to consume and export.

## 1.7 How you can contribute to this review

Our review process to date has involved detailed analysis and public consultation:

- ▼ In March 2018 we released an Issues Paper that set out our proposed approach for the review. We received 410 submissions.
- ▼ We appointed Frontier Economics to provide expert advice on our proposed approach to estimating feed-in tariffs. The Frontier Economics Report is available on our website.

We are now inviting written submissions on this Draft Report from stakeholders by 4 June 2018. Page iii at the front of this report provides information on how to make a submission. Late submissions may not be accepted. We do not have a specific set of

questions for stakeholders to comment on. Instead, we invite stakeholders to address any of our draft decisions, or provide additional information that is relevant to our estimates.

We will also be holding a public hearing on 15 May 2018 at the IPART offices in Sydney, to provide stakeholders with a further opportunity to comment or seek clarification on this report. We encourage stakeholders to register their attendance on our website.

We will consider all the issues raised in submissions and at the public hearing, and provide a Final Report to the Minister by 30 June 2018.

For our following reviews of the benchmark feed-in tariffs (2019-20 and 2020-21) we propose to undertake our consultation and analysis, and complete the reviews in April of each year.



## 1.8 List of draft decisions

1	The all-day solar feed-in tariff benchmark in NSW in 2018-19 is 7.5 c/kWh.	26
2	The time-dependent solar feed-in tariff benchmarks are:	30
	– 6.9 to 7.2 c/kWh between 6:30 am and 3:30 pm (when 90.8% of solar exports occur)	30
	– 8.9 to 11.7 c/kWh between 3:30 pm and 4:30 pm (when 5.8% of solar exports occur)	30
	– 11.3 to 13.3 c/kWh between 4:30 pm and 5:30 pm (when 2.6% of solar exports occur)	30
	– 12.8 to 20.9 c/kWh between 5:30 pm and 6:30 pm (when less than 1% of solar exports occur)	30
	– 8.7 to 9.6 c/kWh between 6:30 pm and 7:30 pm (when less than 0.1% of solar exports currently occur).	30
	– 8.4 to 8.5 c/kWh between 7:30 pm and 8:30 pm (when less than 0.01% of solar exports currently occur).	30

## 1.9 What the rest of this report covers

The rest of this report explains our review and our draft decisions in more detail:

- ▼ Chapter 2 outlines the context for this review
- ▼ Chapter 3 explains our draft decisions on the benchmark for all-day solar feed-in tariffs and the benchmark ranges for time-dependent solar feed-in tariffs for 2018-19
- ▼ Chapter 4 explains our methodology for calculating these benchmarks
- ▼ Chapter 5 explains how we forecast the average wholesale price of 2018-19, which is the key component of our benchmark range
- ▼ Chapter 6 explains how we calculated the solar multiplier.

## 2 Context for this review

To help retailers in setting solar feed-in tariffs, and solar customers in deciding whether these tariffs are reasonable, IPART sets benchmark solar feed-in tariffs each year. However, the revenue customers receive from solar feed-in tariffs is a relatively minor benefit of having solar panels. The main benefit is that customers can save money when they use electricity generated by their solar panels, rather than buying it from their retailer.

As context for our review, the sections below:

- ▼ explain IPART's role in reviewing solar feed-in tariffs
- ▼ provide more information on the financial benefits of having solar panels, and how this varies under different metering arrangements
- ▼ report on the feed-in tariffs currently on offer, and
- ▼ analyse whether higher solar feed-in tariffs lead to lower electricity bills.

### 2.1 IPART's role in reviewing solar feed-in tariffs

We have been reviewing the solar industry since 2011, following the introduction of the Solar Bonus Scheme in 2010. Initially, our role was to set 'retailer contributions' towards the costs of the Solar Bonus Scheme, and to set a benchmark range for solar feed-in tariffs for solar customers who were not part of this scheme<sup>17</sup> (see Box 2.1).

This year, we have received a Terms of Reference under Section 9 of the *Independent Pricing and Regulatory Tribunal Act 1992* (IPART Act) which asks us to review solar feed-in tariffs annually for the next three financial years.

Consistent with our reviews for previous years, we are required to set a benchmark range that:

- ▼ should not lead to solar feed-in tariffs that contribute to higher retail electricity prices, and
- ▼ should operate in a way that supports a competitive electricity market in NSW.

Essentially, these two conditions mean that we cannot set the benchmark range higher than the financial value of the electricity exported by solar customers to a retailer – that is, the price it would pay to purchase that electricity from the NEM.

We are also required to set time-dependent benchmark ranges for solar feed-in tariffs – that is, ranges for electricity supplied to the grid at different times of day.

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<sup>17</sup> IPART, Solar feed-in tariffs – 2011-2012, <https://www.ipart.nsw.gov.au/Home/Industries/Energy/Reviews/Electricity/Solar-feed-in-tariffs-2011-to-2012?qDh=0>, accessed 1 May 2018.

## Box 2.1 IPART's role in reviewing feed-in tariffs over time

### Setting Solar Bonus Scheme 'retailer contributions'

IPART was first asked to review solar exports in 2011. At that time, the NSW Government had introduced the Solar Bonus Scheme, which provided a subsidised feed-in tariff to solar customers from 2010. Initially, the feed-in tariff was set at 60c/kWh. This was reduced to 20c/kWh for participants that entered the scheme between 28 October 2010 and 1 July 2011, when it was closed to new participants. Participants in the scheme received these payments until the scheme ended on 31 December 2016.

Over the life of the scheme, the total amount paid in feed-in tariffs was around \$1.25 billion. Most of the subsidy to customers was funded through a levy on electricity distribution networks, which was passed on to all electricity customers in NSW. However, retailers were also benefiting from the scheme: when customers exported solar energy to the grid, retailers could save on the amount of wholesale electricity they had to purchase from the NEM (National Electricity Market) to supply their customers. Therefore the NSW Government passed legislation that allowed the Minister to ask IPART to determine the 'retailer contribution' to the Solar Bonus Scheme each year based on the value of these savings. We published our first determination in June 2012 for the 2012-13 financial year.

### Setting the benchmark range for customers outside the Solar Bonus Scheme

Customers who installed solar panels after 1 July 2011 were not eligible for the Solar Bonus Scheme. As part of our first review in 2011, the Government asked us to advise whether retailers should be obliged to provide a feed-in tariff for these solar customers, and if so, how it should be set.

We recommended that the best way to implement a feed-in tariff was to set a benchmark range to help guide retailers and customers, based on the savings to retailers. We considered that this would provide the best balance between the risk that regulatory intervention would deter competition for solar customers, against the risk that solar customers may not receive a payment for the value of the electricity they export to the grid without regulatory intervention. We considered that the benchmark range should be set annually because the significant volatility in wholesale prices would make it difficult to set a reasonably accurate range for a period longer than one year.

As part of our 2011 review, we set a benchmark range for 2011-12, and in each year following this review, the NSW Government has asked us to continue to set an unsubsidised benchmark range.

Our legislative role in determining the retailer contribution and benchmark range ended with the conclusion of the Solar Bonus Scheme in December 2016. However, the NSW Government has asked us to continue reviewing solar feed-in tariffs.

**Source:** IPART, *Solar feed-in tariffs*, Final Report, March 2012, pp 145-148, Section 43ECA of the *Electricity Supply Act 1995* (repealed); IPART, *Solar Feed-in tariffs*, Final Report, March 2012, pp 115-116, 101-102, Statutory Review, Report to the Minister for Resources and Energy, August 2014, p ii.

## 2.2 Solar customers make substantial savings off their bills

Most solar customers in NSW have net meters. Under a net metering arrangement customers:

- ▼ Use the electricity they generate to power their home, and they save money because they don't need to buy this electricity from their retailer.
- ▼ Export solar energy to the grid when they generate more electricity than they need to power their home. They may receive a solar feed-in tariff for this amount (if such a tariff is included in their market offer).
- ▼ Import the shortfall from the grid when their solar panels generate less electricity than required to power their home (such as at night). They pay the retail price for this amount.

The savings that customers make off their bills are the largest financial benefit from having solar panels. They are typically much larger than the revenue they make from receiving a solar feed-in tariff for the energy that they export. This means that customers are better off consuming the energy that they generate, which saves them from buying this electricity from their retailer, rather than exporting it to the grid.

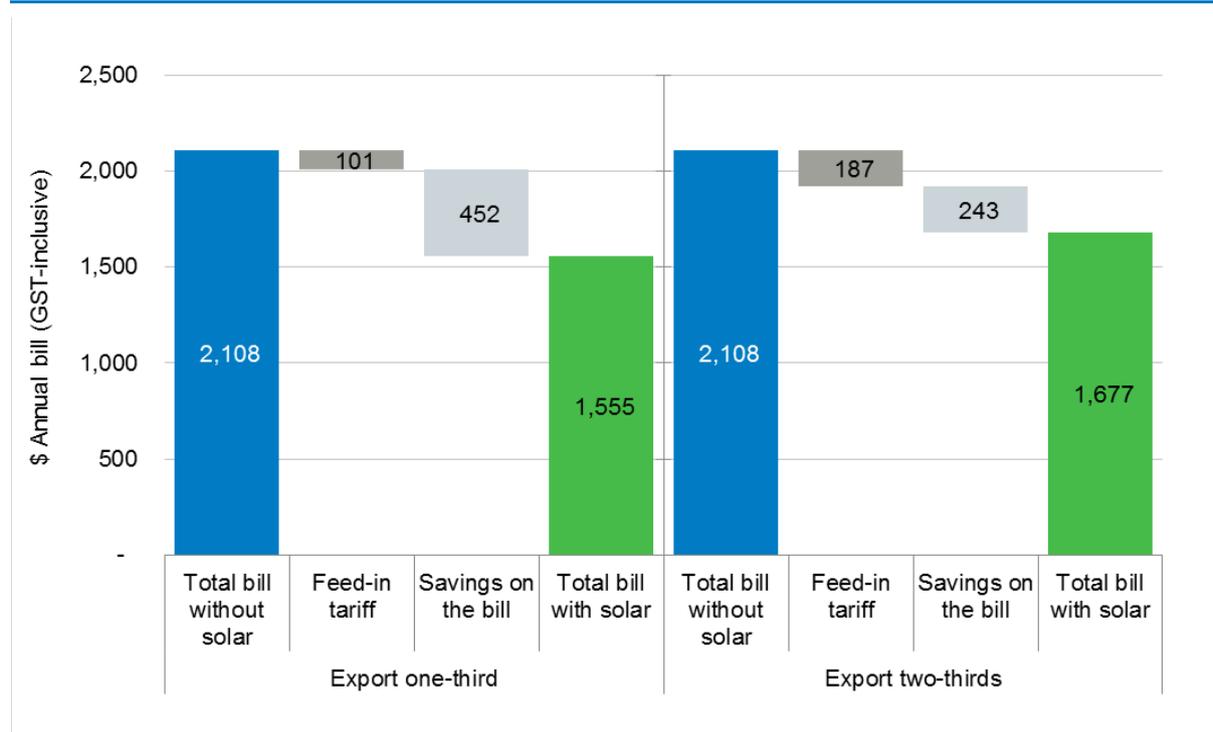
For example, Figure 2.1 shows an example of two customers on a **typical offer** who consume the same amount of energy (6,500 kWh per year), and generate the same amount of energy with panels (around 2,546 kWh with a 2 kW panel). Inclusive of GST, the offer has:

- ▼ a fixed charge of 87.07 cents per day,
- ▼ a consumption charge of 27.5 c/kWh, and
- ▼ a feed-in tariff of 11.3 c/kWh.

The first customer only exports **one-third** of the electricity that they generate (and uses two-thirds to power their home). With a feed-in tariff of 11.3 c/kWh exported, they earn \$101 on the energy they export over the year. The second customer exports **two-thirds** of their solar electricity, and earns a higher amount of \$187 per year.

However, the first customer has a significantly lower bill (\$1,555 compared to \$1,677), because by consuming their energy in the home, they have saved \$452 in retail charges, compared to only \$243 saved by the second customer.

**Figure 2.1 Annual bills for typical solar customers with a net meter**



**Note:** In this example, the 2 kW solar system generates 2,546 kWh per year.

**Source:** IPART analysis using data from energymadeeasy.com.au.

In addition to the savings from their bills and the revenue from feed-in tariffs, solar customers are eligible for a one-off subsidy when they install solar panels under the Commonwealth Small-Scale Renewable Energy Scheme (SRES). The size of the subsidy varies with the size of the system installed, as it is based on the expected generation from the system until the Small-Scale Renewable Energy Scheme ends in 2030. Currently, the subsidy ranges from around \$1,050 to \$1,330 for a 2 kW system to around \$3,000 for a 5 kW system. This covers around 25-35% of the total system costs.<sup>18</sup> The costs of the Small-Scale Renewable Energy Scheme subsidy are paid for by retailers, and passed onto customers through electricity retail prices.

### 2.2.1 Customers are currently better off with net meters than gross meters

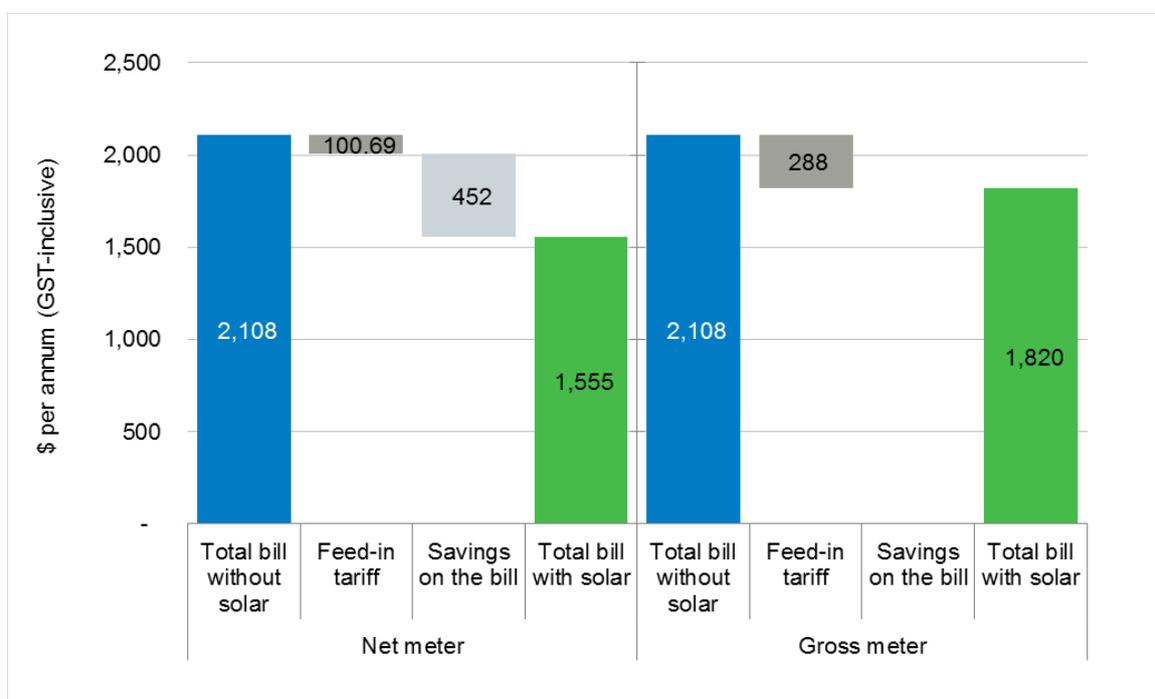
Unlike customers with net meters, customers with **gross meters** do not make savings off their bill when they generate solar electricity. All the energy that they generate is exported to the grid, and they earn a feed-in tariff on this energy. They then have to buy all the energy that they use from their retailer. Customers with gross meters will only be better off than customers with net meters if their feed-in tariff is higher than the retail price of electricity. This was the case under the Solar Bonus Scheme, when the initial feed-in tariff was 60 c/kWh, outlined in Box 2.1 above.

<sup>18</sup> The values for financial incentives under the Small-Scale Renewable Energy Scheme assume the solar unit is installed in Sydney on 24 April 2018. The dollar range is based on certificate prices of \$30 and \$38. Clean Energy Regulator, *Small generation unit STC calculator*, <https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator>, accessed 24 April 2018; Green Electricity Markets, *STC Market Prices*, <http://greenmarkets.com.au/resources/stc-market-prices>, accessed 24 April 2018. Solar Choice, *Current Solar System Prices: Residential and Commercial*, <https://www.solarchoice.net.au/blog/solar-power-system-prices>, accessed 24 April 2018.

Figure 2.2 shows the difference in the annual bill for the same offer as in Figure 2.1, however, in this example one customer has a net meter, and one customer has a gross meter. The customers consume two-thirds of the energy they generate, and export one-third to the grid.

For the customer with the gross meter, for each kilowatt hour they use at the same time their panels are exporting electricity, they pay the full 25 cents for the usage tariff, to their retailer, and receive a 11.3 cent feed-in tariff for the electricity they generate. This means that they pay a net amount of 13.7 cents for this electricity that they consume. By contrast, with a net meter, for each kilowatt hour a customer generates and consumes themselves, they receive no feed-in tariff, but they save the full 25 cents on the retail price of electricity because they can avoid purchasing this electricity from their retailer. Figure 2.2 shows that in this example, for the same consumption and solar exports, the customer with the net meter is \$265 better off.

**Figure 2.2 Annual bills for customer with net meter versus gross meter**



**Note:** In this example, the 2 kW solar system generates 2,546 kWh per year.

**Source:** IPART analysis using data from energymadeeasy.com.au.

Solar customers who still have a gross meter can ask their retailer to install a net meter. Retailers may charge customers for the costs of the meter and installation.

We note that throughout 2017, it sometimes took several months for retailers to install a net meter after receiving a customer request. The Energy and Water Ombudsman (EWON) received a large number of complaints about installation delays. These delays were due to a range of factors – including installations taking more time than expected; a lack of qualified installers, aged/damaged house/meter wiring; the presence of asbestos or other meter

board/box quality issues; and problems with access to meters. EWON is working with retailers to resolve these issues.<sup>19</sup>

### 2.3 Retailers are currently offering feed-in tariffs of around 6-20 cents

As at April 2018, 20 of the 25 retailers operating in NSW offered a solar feed-in tariff as part of their generally available market offers.<sup>20</sup> These tariffs varied from 6.1 cents to 20 c/kWh (Figure 2.3). Retailers offered the same feed-in tariff across each network area where they were selling electricity.

Our recommended benchmark range for 2017-18 is 11.9 c/kWh (for off-peak times) to 15.0 c/kWh (at peak times).<sup>21</sup> We note that for their generally available offers, all retailers are offering a flat all-day rate across the whole day, rather than different feed-in tariffs for peak and off-peak times. IPART's equivalent all-day benchmark is 12.8 c/kWh. However, some retailers are partnering with technology companies and offering pricing plans that intermittently pay customers more than \$1 per kWh, or around 10 times the usual rate to provide an incentive for customers to export electricity during extreme high price events (for more details see Box 3.2 in Chapter 3).

When comparing retailers' all-day feed-in tariffs to our benchmark feed-in tariff range for 2017-18, we found that of the retailers offering tariffs:

- ▼ Eighteen offered a solar feed-in tariff that was below our all-day benchmark feed-in tariff of 12.8 c/kWh, and 15 of these were below the lower end of the benchmark range. The lowest of these was 6.1 c/kWh.
- ▼ Six offered a feed-in tariff equal or greater than our all-day benchmark, with five retailers offering more than 15.0 c/kWh (the upper end of the benchmark range). The highest of these was 20 c/kWh.
- ▼ Five retailers had more than one solar feed-in tariff option.

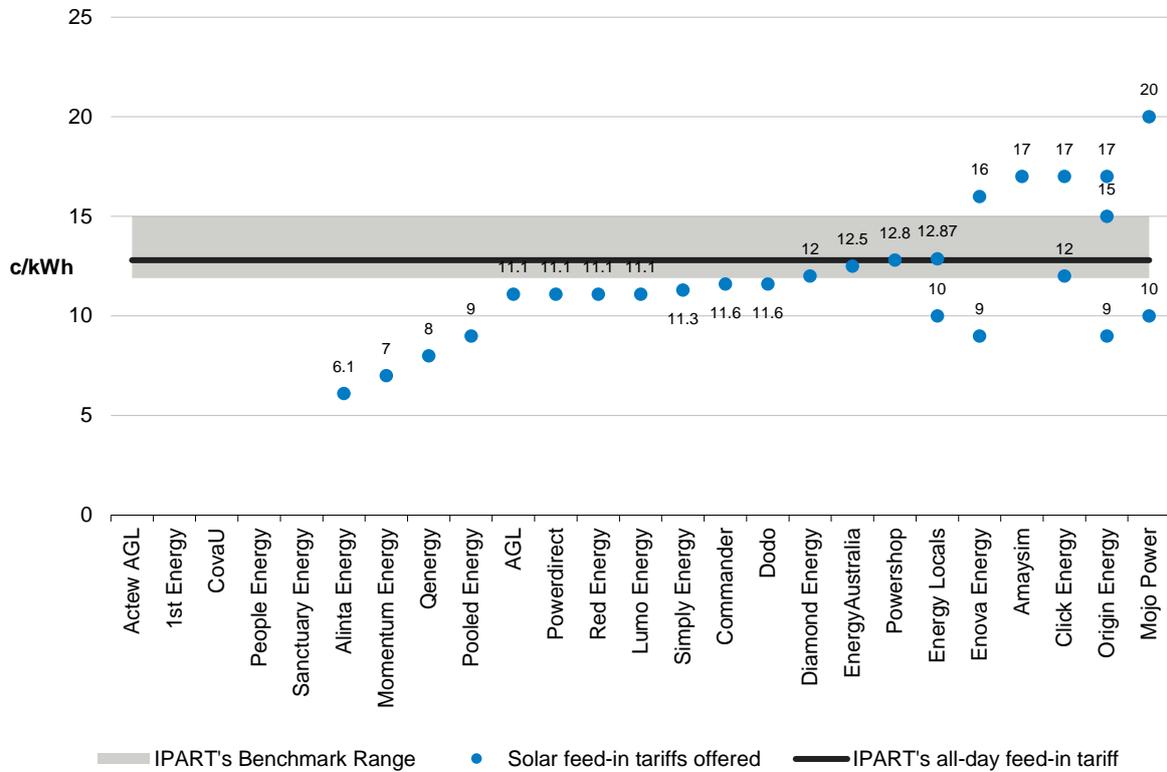
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<sup>19</sup> EWON, *Consumer Issues*, 16 March 2018, <https://www.ewon.com.au/page/publications-and-submissions/annual-reports/2016-17/consumer-issues>

<sup>20</sup> Data from [www.energymadeeasy.com.au](http://www.energymadeeasy.com.au).

<sup>21</sup> IPART, *Solar feed-in tariffs – benchmark range 2017-18*, Final Report, June 2017, p 1.

**Figure 2.3 Solar feed-in tariffs available in NSW, based on retailers' market offers in April 2018**

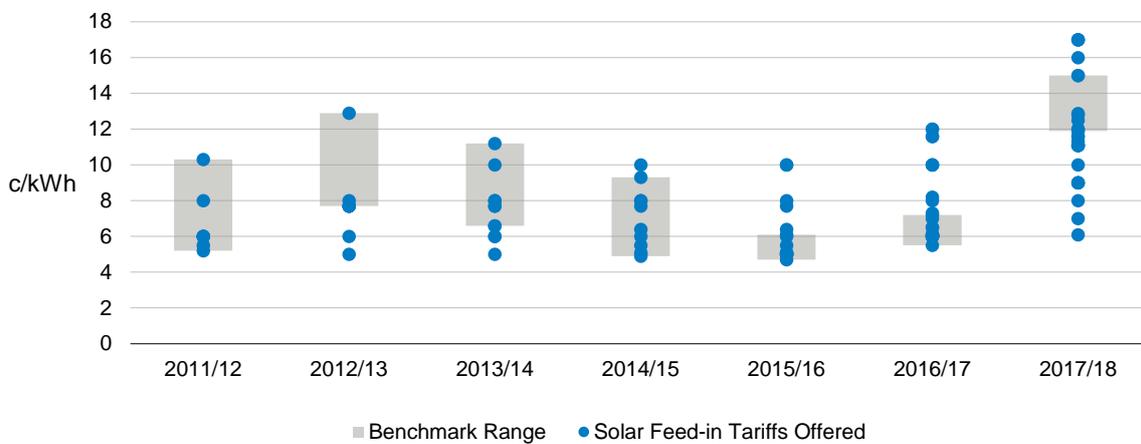


**Note:** Enova Energy was only retailing in the Essential Energy network area and Pooled Electricity was only supplying electricity in the Ausgrid and Endeavour Energy network areas.

**Data source:** IPART analysis, using data from [www.energymadeeasy.com.au](http://www.energymadeeasy.com.au).

Figure 2.4 shows that feed-in tariffs offered in the market have changed from year to year, mainly reflecting the fluctuation in the forecast average wholesale prices.

**Figure 2.4 IPART's solar benchmarks over time (2011-12 to 2017-18, nominal \$)**



**Source:** IPART reports, and IPART analysis using data from [energymadeeasy.com.au](http://energymadeeasy.com.au).

## 2.4 Do higher feed-in tariffs lead to lower electricity bills?

When solar customers are comparing retailers' market offers, the level of the feed-in tariff included in the offer is not the only factor they should consider. Most solar customers import much more electricity than they export, and so the most important driver of their bills is the retail price they pay to buy electricity when their solar panels are not generating (such as at night or on cloudy days when the sun is not shining). Customers also pay a fixed retail charge of around 80 cents to \$1.50 per day. Other important factors are the terms and conditions associated with the offer, such as any contract period, early termination fees etc. This means that offers with higher feed-in tariffs will not necessarily result in lower bills.

We analysed the offers that are currently being offered to customers to consider whether customers are likely to be better off on offers with higher solar feed-in tariffs. Figure 2.5 compares the annual bills for all solar offers that are currently available in the Ausgrid network area. We calculated the bills for a solar customer with a 2 kW system (around 8 panels), assuming they used the average amount of electricity (6,500 kWh), and used two-thirds of it in their home.

It shows that there is not a strong correlation between customers' total bills and the feed-in tariff offered. For many offers, a customer is better off overall with a lower-feed-in tariff (because the retail tariffs offered by retailers are also lower). Of the offers in the market that resulted in the highest bills, some had high feed-in tariffs, and others had lower feed-in tariffs.

**Figure 2.5 Annual bills and feed-in tariffs (April 2018, Ausgrid network area)**



**Note:** In this example, the 2 kW solar system generates 2,546 kWh per year.

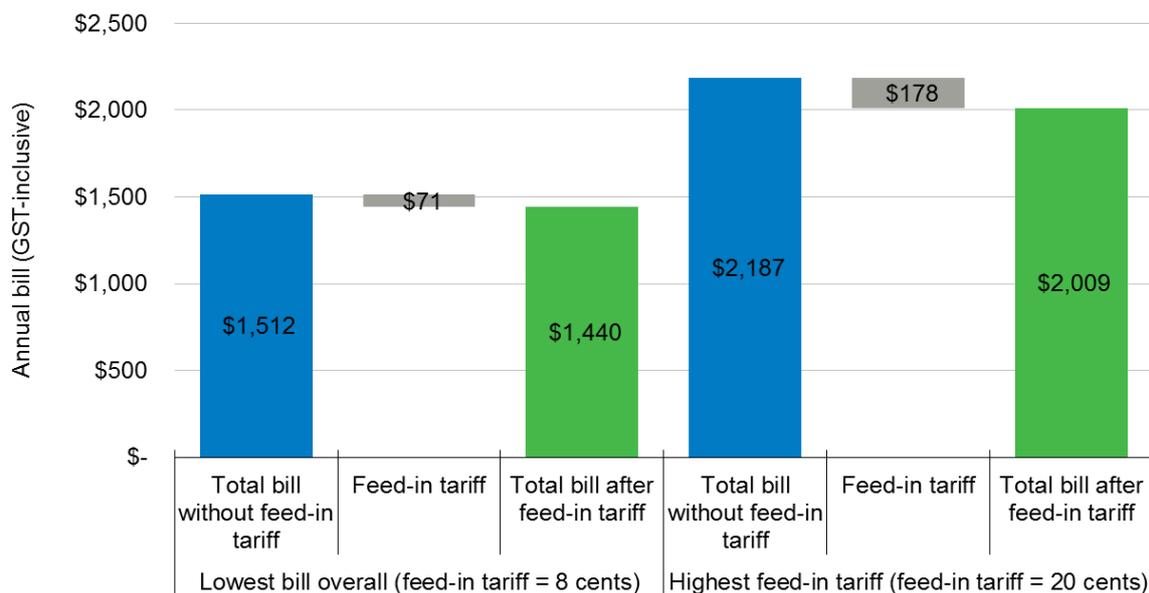
**Data source:** IPART analysis using data from energymadeeasy.com.au.

Figure 2.6 compares the annual bills for two of the offers shown in Figure 2.5 for a customer with a 2 kW system, who consumes 6,500 kWh per year and exports one-third of the electricity they use to the grid (and uses the rest to supply their home):

- ▼ The highest feed-in tariff offer pays a feed-in tariff of 20 c/kWh, has a consumption tariff of 27.9 c/kWh, plus a daily supply charge of \$1.80 per day.
- ▼ The best offer overall pays a feed-in tariff of 8 c/kWh feed-in tariff, has a consumption tariff of 23.10 c/kWh, plus a daily supply charge of 88 cents.

The annual bill for a customer on the highest feed-in tariff offer is \$2,009, which is \$569 higher than the bill for an identical customer on the best offer (\$1,440). This reflects the lower retailer charges of the best offer overall.

**Figure 2.6 Comparison of two offers with different solar feed-in tariffs (exporting one-third of generation)**



**Note:** In this example, the 2 kW solar system generates 2,546 kWh per year.

**Data source:** IPART analysis using data from energymadeeasy.com.au

## 3 Solar feed-in benchmarks for 2018-19

As Chapter 2 discussed, this year we have been asked to set a benchmark range for all-day solar feed-in tariffs as well as benchmark ranges for time-dependent solar feed-in tariffs. The sections below provide an overview of our draft decisions on the solar feed-in benchmarks for 2018-19, and then explain in broad terms how and why we reached those decisions. Chapters 4 to 6 discuss our approach in more detail.

### 3.1 Overview of draft decisions for 2018-19

We have made a draft decision that the benchmark for all-day solar feed-in tariffs in NSW in 2018-19 is 7.5 c/kWh. This benchmark reflects our forecast of what 1 kWh of energy exported by solar customers would be worth if it could be sold on the wholesale spot market (the National Electricity Market or NEM) in the same way as energy produced by other generators.<sup>22</sup>

We have set a single value for this benchmark, rather than a range, because our forecast indicates there will be much less variation in the value of solar exports at different times of the day than in previous years. This is particularly the case between 6:30 am and 3:30 pm, which is when more than 90% of exports from solar customers occur.<sup>23</sup>

We have made a draft decision that the benchmark ranges for time-dependent solar feed-in tariffs are:

- ▼ 6.9 to 7.2 c/kWh between 6:30 am and 3:30 pm (when 90.8% of solar exports occur)
- ▼ 8.9 to 11.7 c/kWh between 3:30 pm and 4:30 pm (when 5.8% of solar exports occur)
- ▼ 11.3 to 13.3 c/kWh between 4:30 pm and 5:30 pm (when 2.6% of solar exports occur)
- ▼ 12.8 to 20.9 c/kWh between 5:30 pm and 6:30 pm (when less than 1% of solar exports occur)
- ▼ 8.7 to 9.6 c/kWh between 6:30 pm and 7:30 pm (when less than 0.1% of solar exports currently occur).
- ▼ 8.4 to 8.5 c/kWh between 7:30 pm and 8:30 pm (when less than 0.01% of solar exports currently occur).

Retailers to date have not offered time-dependent solar feed-in tariffs as customers have limited ability to respond to a high feed-in tariff in the very late afternoon. However, our draft benchmark ranges illustrate the potential for such tariffs to provide a price signal to solar customers with battery storage systems or who are considering purchasing such systems about when they should export to the grid.

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<sup>22</sup> This is a hypothetical concept, as customers with small-scale solar PV cannot sell their exported energy into the wholesale spot market.

<sup>23</sup> All solar export percentages are based on the sample of 500 customers in the Ausgrid region (average 2014-15 to 2016-17).

In line with the requirements under our Terms of Reference, we have set the solar feed-in benchmarks for one year, rather than multiple years as some stakeholders suggested. Due to the substantial fluctuations in wholesale prices between years, we consider that it would not be possible to set a reasonably accurate range for longer than one year.

### **3.2 Our draft benchmark for all-day solar feed-in tariffs is 7.5 c/kWh**

As indicated above, our draft benchmark for all-day solar feed-in tariffs for 2018-19 is 7.5 c/kWh. This benchmark reflects our forecast of what a solar customer's exported energy would be worth if it could be sold on the NEM like other generation. It is also around the same as the average price of wholesale for the whole day (ie, not weighted by solar output).

To reach this decision, we:

- ▼ Forecast the average wholesale electricity price on the NEM in 2018-19 using NSW baseload electricity futures contracts for this year traded on the Australian Stock Exchange (ASX), averaging the daily close price over 40 days, and then adjusting it down by 5% to reflect that contracts typically trade at a premium to spot prices. Chapter 5 provides information on how we estimate the average wholesale price.
- ▼ Applied a 'solar multiplier' which reflects whether wholesale prices are likely to be higher or lower than this average price at the times when solar exports occur. This is necessary because, in the NEM, wholesale electricity prices are set for each half hour across the day, based on supply and demand at that time. Typically, they are lowest at night (when demand is lowest) and through the middle of the day (when solar energy meets a proportion of demand). We estimate the multiplier using historical data on wholesale prices and the timing of solar exports. Chapter 6 discusses our methodology for calculating the solar multiplier.
- ▼ Grossed up solar generation to the NSW node using an estimated loss factor. Supplying customers with solar exports also means that retailers require slightly less energy than they otherwise would if they were purchasing this energy from the NEM. This is because solar exports tend to be consumed close to where the electricity is produced, and so the electricity losses that usually arise as electricity flows through the transmission and distribution network are avoided.
- ▼ Added the value of the NEM fees and charges that a retailer would have paid if they purchased the wholesale energy in the NEM. Retailers do not have to pay NEM fees and charges on solar exports because they are accounted for in the NEM through a lower demand profile. However, retailers do have to pay network fees and the costs of environmental policies on all electricity that they supply.

The contribution of each of these components to our draft benchmark for the all-day solar feed-in tariff for 2018-19 and our benchmark ranges for the previous two years are shown in Figure 3.1. As this figure indicates, our draft benchmark for 2018-19 is lower than the benchmark for 2017-18, mainly because the forecast average wholesale price is lower in 2018-19.

Figure 3.1 also shows that unlike previous years, the solar multiplier has not resulted in a 'premium' over and above the average wholesale price for 2018-19. This is because we forecast that the value of solar exports will be around the same as the average price of energy across the day – and so we have calculated a solar-multiplier of 0.99. In contrast, in previous years, we forecast that the value of solar exports would be slightly higher than the average price across the day. For example, in 2017-18, a solar multiplier of 1.14 added an extra 1.5 cents to the wholesale value of solar exports.

Finally, Figure 3.1 shows that electricity losses and estimated NEM fees and charges are relatively small components of the benchmark feed-in tariff, contributing less than 0.2 cents to the benchmark. This is similar to previous years.

**Figure 3.1 Change in the value of solar exports over time (all-day tariff)**



**Note:** 2018-19 estimates based on loss factors for 2017-18, and projected fees and charges for 2018-19.

**Data source:** IPART, AEMO.

For our Final Report, we will update our draft benchmark for all-day solar feed-in tariffs to reflect:

- ▼ the most up-to-date forecast wholesale electricity price averaged over 40 days as at 15 May 2018,
- ▼ updated loss factors, and
- ▼ updated NEM fees and charges.

### 3.3 We propose to set a single benchmark for the all-day solar feed-in tariff rather than a range

In previous years, we have set the benchmark range based on the value of solar at different times of the day. We set the top of the range based on the two-hour window when the value of solar exports was forecast to be highest (this was between 2 pm and 4 pm in 2017-18), and the bottom of the range based on the value of exports at all other times. However, for 2018-19, our forecast indicates that the value of solar exports will hardly vary across the times of the day when most of these exports occur.

For example, Table 3.1 compares our forecasts of the value of solar between 2 and 4 pm (when around 20% of export occur) for 2018-19 with the our forecasts for 2017-18. It shows that last year, we forecast the value of solar exports in this peak window to be 15 c/kWh, compared to an all-day average value of 12.8 c/kWh. In contrast, for 2018-19, we forecast that the average value of solar between 2 and 4 pm will be 7.7 c/kWh, which is only slightly above the all-day average value of 7.5 cents.

**Table 3.1 Forecast value of solar exports in 2018-19 compared to 2017-18**

	2017-18 c/kWh	2018-19 c/kWh
<b>2 pm to 4 pm (2017-18 peak)</b>	15	7.7
<b>All other times</b>	11.9	7.4
<b>All-day</b>	12.8	<b>7.5</b>

**Note:** Last year we set a benchmark range based on the value of solar exports in the peak-time as the top of the range, and the value at all other times as the bottom of the range. This year we are focussing on an all-day benchmark.

For 2018-19, we forecast that the two-hour window with the highest value of solar exports is likely to occur after 5:30 pm. However, less than 1% of all solar exports occur after this time. Because such a small amount of generation occurs in this time window, we considered that setting the top of the range in line with the value of solar during this time in the same way as we have done in previous years would not provide a realistic guide to customers about the value of solar for the majority of their exports, and could result in inaccurate pricing expectations for consumers.

As a result, we have made a draft decision to set a single 'all-day' benchmark for this review. This single benchmark also provides a more useful comparator for the offers that are currently available in the market, which provide only one feed-in rate regardless of the time that solar exports into the market.

#### Draft decision

- 1 The all-day solar feed-in tariff benchmark in NSW in 2018-19 is 7.5 c/kWh.

### 3.4 We propose to set time-dependent benchmark ranges

As noted in Chapter 2, we have also been asked to set benchmarks for time-dependent feed-in tariffs. Retailers could offer different feed-in tariffs across the day as an alternative to an all-day rate (however, currently retailers are choosing to offer their customers a single feed-in tariff that applies at all times).

Our draft decision on the benchmark ranges for these tariffs is shown in Table 3.2.

Some stakeholders also considered that our time-dependent feed-in tariffs should promote the efficient deployment and use of batteries.<sup>24</sup> An individual submitted that:

Technology now enables small scale PV generators to move from self-consumption including battery storage, hot water, pool heating or pool filtering. The FiT model needs to be open to available technology rather than technology from the 20<sup>th</sup> century.<sup>25</sup>

Only around 1,600 households in NSW currently have batteries, representing less than 0.1% of households.<sup>26</sup> However, we agree that over time, as battery prices fall and their uptake increases, a price signal for battery exports will become more important. Therefore, we have not limited our solar benchmarks to daylight hours. We are proposing to set evening benchmarks to provide a price signal to customers with batteries, or considering purchasing batteries, about when they should export their energy to the grid.

PIAC submitted that IPART should align the time interval with those of consumption tariffs where it is practical, and not inefficient to so.<sup>27</sup> However, we are proposing to set more granular feed-in tariff benchmark ranges to provide better information about the value of solar exports at different times of day.

**Table 3.2 Draft benchmark ranges for time-dependent solar feed-in tariffs**

Time window	2018-19 (c/kWh)	Proportion of solar exports
6:30 am to 3:30 pm	6.9 – 7.2	90.8%
3:30 pm – 4:30 pm	8.9 – 11.7	5.8%
4:30 pm – 5:30 pm	11.3 – 13.3	2.6%
5:30 pm – 6:30 pm	12.8 -20.9	0.72%
6:30 pm – 7:30 pm	8.7 – 9.6	0.07%
7:30 pm – 8:30 pm	8.4 - 8.5	0.002%

We set the benchmarks based on the key shifts in the value of solar exports throughout the day, which can be seen in Figure 3.2. In particular, we:

- ▼ set one benchmark between 6:30 am and 3:30 pm, because there is very little variation in wholesale prices across these times, and
- ▼ set benchmarks for each **one-hour** period after 3:30 pm, when there is much more wholesale price variation.

Figure 3.2 shows that solar exports after 6:30 pm are negligible. As noted above, the main reason for setting these benchmarks is to provide a price signal for the value of battery exports. Therefore the 6:30 and 7:30 pm benchmarks are not solar output-weighted because battery exports during these windows could occur equally at any time.

Figure 3.2 also shows that the average value of solar is higher in the afternoon. This means it would be more cost-reflective if retailers offered a higher feed-in tariff in the afternoon, compared to the morning rate. If this were the case, some customers might respond by supplying a greater proportion of their exports to the market during the afternoon (for

<sup>24</sup> For example, see submission to IPART Issues Paper from PIAC, April 2018, p 2.

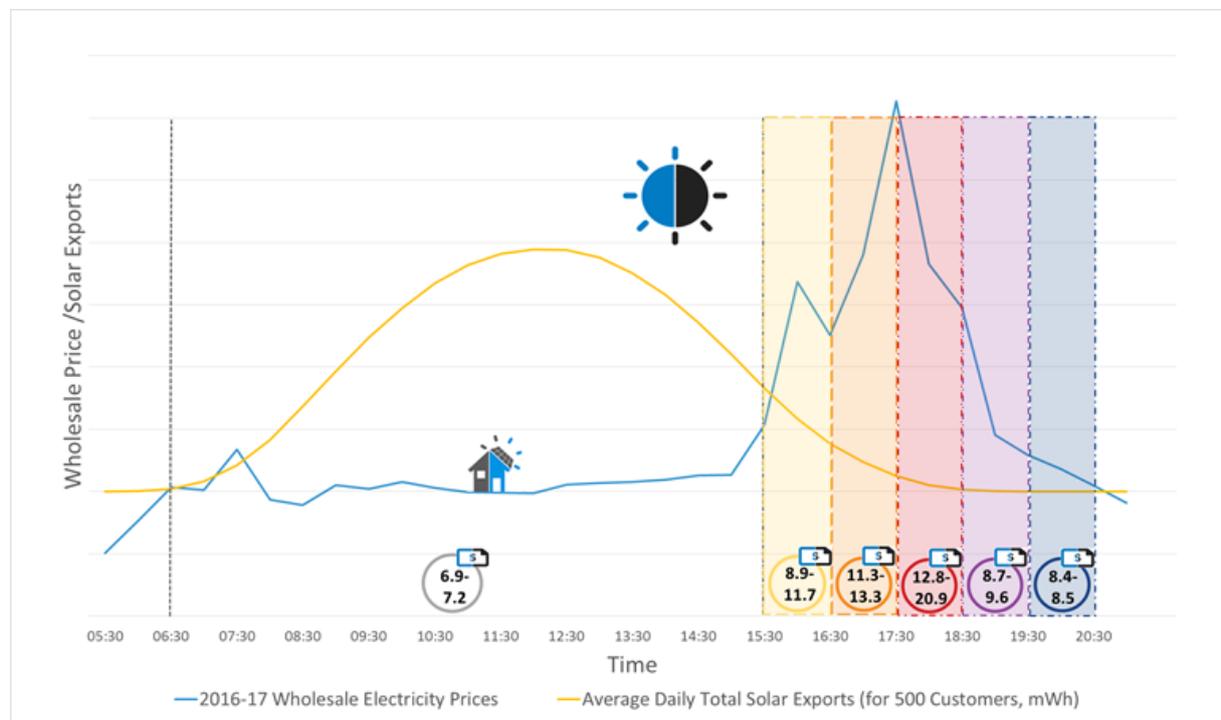
<sup>25</sup> Submission to IPART Issues Paper from L. Johnson, March 2018, p 1.

<sup>26</sup> Australian Energy Council, Solar Report – January 2018, p 6.

<sup>27</sup> PIAC submission to IPART Issues Paper, April 2018, p 1.

example, they may choose to install panels that face more towards the west instead of north). Supplying more energy to the grid when it is most needed could help drive market-wide efficiencies by putting downward pressure on wholesale prices at these times.

**Figure 3.2 Draft time-dependent feed-in tariffs**



**Data source:** IPART analysis, based on data from AEMO and Ausgrid.

The peak prices in the late afternoon and evening are being driven by high levels of electricity demand at the same time of the day as solar output is falling. Higher wholesale prices in the evening also reflect increasing ‘peakiness’ of wholesale prices in recent years, as the demand-supply balance has tightened, particularly following the closure of Hazelwood in Victoria in March 2017. This means that prices are often driven by higher cost generation (such as gas generators) when demand is highest.

We note that while time-dependent feed-in tariffs are likely to be more cost-reflective, retailers currently set an all-day rate. As mentioned in the previous section, there is very little variation in the value of the vast majority of solar exports. AGL submitted that its current practice of offering only a single all-day solar feed-in tariff is simple to understand and does not create complexity and additional costs to retail operations.<sup>28</sup>

Red Energy also noted that without the requisite customer uptake, retailers would incur system and process costs to implement more granular feed-in tariffs with the risk of under-recovery. Further, it submitted that most consumers in NSW do not have a smart meter and will not benefit from more granular feed-in tariffs. It submitted that time-dependent benchmarks are not required to be set by IPART.<sup>29</sup>

<sup>28</sup> AGL submission to IPART Issues Paper, April 2018, p 2.

<sup>29</sup> Red Energy and Lumo Energy Australia submission to IPART Issues Paper, April 2018, p 1.

### 3.5 We used different years of data to set the values at the top and bottom of our time-dependent benchmark ranges

Like our draft benchmark for all-day solar feed-in tariffs, we propose to set our time-dependent feed-in tariffs by:

- ▼ Forecasting the average wholesale electricity price for 2018-19 (from NSW futures contracts).
- ▼ Applying a 'solar multiplier' based on historical data about whether wholesale electricity prices are likely to be higher or lower than the average price at the times when solar exports occur. The solar multiplier for each time window is different, which is why feed-in tariff benchmarks are different in each time window.<sup>30</sup>

The value of the solar multiplier for each time window depends on the historical price and export data that we use. We estimated the multiplier using price and export data for 2016-17, because this year is most likely to reflect the supply conditions in the NEM for 2018-19, as it includes the exit of the Hazelwood coal-fired generator which has tightened demand-supply conditions.

However, supply is not the only determinant of wholesale prices. Factors such as weather have a substantial impact on demand (and therefore wholesale prices) and can fluctuate from year to year. Other one-off events such as power plant outages may also be inconsistent between years, and so are more accurately captured with several years of data. Therefore, we also modelled the solar multiplier using the two most recent years of data, and the most recent three years of data, to capture these factors over a longer time period.

We set a range based on the solar multiplier results for each of these three historical periods (2014-15 to 2016-17, 2015-16 to 2016-17 and 2016-17 only). For example, for the 5:30 to 6:30 pm time window, the bottom of the range (12.8 c/kWh) is based on solar multiplier (1.75) from the three years of historical data, and the top of the range (20.9 c/kWh) is based on the solar multiplier for the 2016-17 period only (2.76).

We note that we used the same approach when we considered the all-day benchmark. However, regardless of the historical data used, the value of the solar multiplier was virtually identical. Therefore it was not necessary to set a **range** based on different historical data sets.

Our methodology for estimating the solar multiplier is set out in detail in Chapter 6, including our analysis of which historical years to use in our modelling, and the solar multiplier result for each historical period.

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<sup>30</sup> As part of our methodology to calculate the value of solar exports, we also:

- multiply the value by a loss factor, to gross up solar generation to account for the avoided losses that usually arise as electricity flows through the transmission and distribution networks because solar exports tend to be consumed close to where the electricity is produced, and
- add the value of the NEM fees and charges that are avoided, because these charges are levied on retailers' net purchases.

## Draft decision

- 2 The time-dependent solar feed-in tariff benchmarks are:
- 6.9 to 7.2 c/kWh between 6:30 am and 3:30 pm (when 90.8% of solar exports occur)
  - 8.9 to 11.7 c/kWh between 3:30 pm and 4:30 pm (when 5.8% of solar exports occur)
  - 11.3 to 13.3 c/kWh between 4:30 pm and 5:30 pm (when 2.6% of solar exports occur)
  - 12.8 to 20.9 c/kWh between 5:30 pm and 6:30 pm (when less than 1% of solar exports occur)
  - 8.7 to 9.6 c/kWh between 6:30 pm and 7:30 pm (when less than 0.1% of solar exports currently occur).
  - 8.4 to 8.5 c/kWh between 7:30 pm and 8:30 pm (when less than 0.01% of solar exports currently occur).

### 3.6 We only set our draft benchmark feed-in tariffs for one-year

Our draft decision is to set feed-in tariffs for the next financial year (2018-19). This is consistent with our Terms of Reference which ask us to set the feed-in tariffs for each of the next three years on an annual basis.

Some stakeholders submitted that we should set a multi-year benchmark range, and that we should complete our reviews of solar feed-in tariffs earlier, so there is more time for retailers to signal their feed-in tariffs for the following financial year. For example, the submission from the Central NSW Councils argued that feed-in tariff pricing should be provided for more than 1 year, such as on a 3-5 year basis and the review be brought forward 6 months. It argued that a longer time period was necessary to provide medium term certainty on feed-in tariffs for households and solar investors, and to allow people to assess the likely savings the solar electricity would provide.<sup>31</sup>

We consider that we should continue to set the benchmark range annually, because it would not be possible to provide a good guide for wholesale prices for a period longer than a year. This is because fluctuations in the wholesale market between years make it difficult to set a reasonably accurate range for longer time periods.

For our following reviews of the benchmark feed-in tariffs (both the 2019-20 and the 2020-21 reviews) we proposed to undertake our consultation and analysis and complete the reviews in April of each year. We agree with stakeholders that having the benchmark available before June would assist both consumers and retailers. As the benchmark is based on forecasting wholesale electricity prices for the next financial year we consider that on balance, completing the review in April (so that our forecast captures data up to the end of March) would be more useful for stakeholders than completing our reviews in December (so that our forecast captures data to the end of November).

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<sup>31</sup> Central NSW Councils submission to IPART Issues Paper, April 2018, pp 3-4. See also submissions to IPART Issues Paper from Sunny Shire, April 2018, p 1, L. Johnston, 31 March 2018, p 1.

### 3.7 We continue to prefer setting benchmarks for solar feed-in tariffs over regulating minimum feed-in tariffs

As in previous years, some stakeholders submitted that retailers should be required to pay a minimum feed-in tariff, as is the case in some other states (See Box 3.1), rather than IPART setting a voluntary benchmark range.<sup>32</sup>

On the other hand, Red Energy and Lumo Energy Australia submitted that IPART's role in publishing a benchmark feed-in tariff is unnecessary as there is substantial competition in the NSW market.<sup>33</sup>

PIAC submitted that it accepts that a regulated minimum for feed-in tariffs may not be required at this time, but it stresses that retail feed-in tariff offerings must be monitored to ensure a reasonable value is passed on to consumers. It submitted that IPART should monitor feed-in tariffs and whether metering charges for solar customers are reasonable. It considered that there are commercial incentives for retailers to not pass on the full value of distributed energy to customers, including that it may not be in their interests to promote the entry of solar customers into the market.<sup>34</sup>

#### Box 3.1 How NSW regulatory requirements for solar feed-in tariffs compare to those in other states

The regulatory requirements related to offering solar feed-in tariffs are different in each state. NSW is the only state in which the price regulator sets a voluntary benchmark range.

As in NSW, retailers are not obliged to offer feed-in tariffs in South East Queensland, South Australia, and the ACT. Price regulators in South Australia and Queensland monitor the feed-in tariffs that are offered in the market. In these states, the market offers are wide ranging. For example, the current offers in South Australia range from 6.8 to 22 c/kWh.

In Victoria, regional Queensland and Tasmania, retailers **are** obliged to offer solar customers a feed-in tariff, and regulators or State Governments set a minimum solar feed-in tariff. The current regulated minimum rates are around 9-10 c/kWh. In Western Australia, retailers are also obliged to offer customers a feed-in tariff, which must be approved by the Public Utilities Office, but the Government does not set a minimum.

**Source:** Essential Services Commission, *Minimum Electricity Feed-in Tariffs to Apply from 1 July 2018*, Final Decision, 27 February 2018, p iv;

Queensland Competition Authority, *Solar Feed-in Tariff Report 2016-17*, October 2017, p ii; QCA, *Solar feed-in tariff for regional Queensland for 2017-18*, May 2017, p 7. Essential Services Commission of South Australia, *Monitoring South Australian Feed-in Tariffs Paid by Electricity Retailers to Solar Energy Exporters: July 2017 update*, 31 August 2017, p 1. Synergy, *Renewable Energy Buyback Scheme*, [https://www.synergy.net.au/-/media/Files/PDF-Library/REBS\\_Pricing\\_Schedule.pdf?la=en&hash=F17D284A297E4097400F1E8FA44BB106C7B98824](https://www.synergy.net.au/-/media/Files/PDF-Library/REBS_Pricing_Schedule.pdf?la=en&hash=F17D284A297E4097400F1E8FA44BB106C7B98824), accessed 16 April 2018; Office of Tasmania Economic Regulator, *Feed-in Tariffs*, <http://www.economicregulator.tas.gov.au/electricity/pricing/feed-in-tariffs>, accessed 16 April 2018.

We don't have the power to set a mandatory feed-in tariff, as the Government has asked us to recommend a benchmark range. However, we have considered whether this would be in the long-term interest of customers.

<sup>32</sup> See submissions to IPART Issues Paper from I. Anderson, April 2018, p 1, J. Everingham, April 2018, p 1; and L. Martello, April 2018, p 1.

<sup>33</sup> Red Energy and Lumo Energy Australia submission to IPART Issues Paper, April 2018, p 1.

<sup>34</sup> PIAC submission to IPART Issues Paper, April 2018, p 2.

In our view, there is no need to regulate solar feed-in tariffs. Our view is that competition is providing an effective incentive to retailers to offer customers cost-reflective feed-in tariffs, and a range of offers are available to customers. In addition, much of the recent innovation in the electricity retailer market has been in relation to solar electricity. For example, some retailers have partnered with technology companies and are offering pricing plans that intermittently pay customers more than \$1 per kWh, or around 10 times the usual rate to provide an incentive for customers to export electricity during extreme price events (See Box 3.2).

There could be benefits to customers and retailers if customers were offered a more cost reflective price signal to reflect these types of events, and lower feed-in tariffs the rest of the time. But a regulated minimum feed-in tariff at *all times* might impede such innovation.

We also note that since other components of electricity tariffs are not regulated, it would be inconsistent to regulate only the feed-in tariff. In addition, regulating just the feed-in tariff would be unlikely to benefit customers as retailers would adjust the other components of their tariffs to account for any losses or gains from the regulated rate. As shown in Chapter 2, a likely consequence of a higher feed-in tariff is higher retail rates.

### **Box 3.2    Tariff innovation for solar customers**

Retailers currently do not offer time-dependent solar feed-in tariffs in their generally available offers. However, some retailers are partnering with technology companies and trialling pricing plans that intermittently pay customers over and above their feed-in tariffs for exporting to the grid during extreme high price events.

An example is technology provided by Reposit Power. Reposit began trialling its software in late 2014 after receiving funding from The Australian Renewable Energy Agency. Reposit currently offers a range of smart energy management products in NSW including:

- ▼ **Consumption optimisation software**, which intelligently controls when the home draws power from batteries, straight from rooftop panels, or from the grid to minimise bills.
- ▼ **Virtual Power Plant packages for commercial customers** (such as networks, retailers, property developers, solar installers, community groups). These are fleets of distributed electricity generating assets (solar panels, batteries, and possibly electric vehicles owned by homes and businesses) that are coordinated centrally to smooth peak demand, manage wholesale market volatility risk, and minimise costs. Networks are also offered control over power quality factors like voltage.

Reposit has partnered with retailers including Diamond Energy, Powershop, and Simply Energy, and these retailers offer their customers up to \$1/kWh for panel or battery exported solar electricity during extreme price events, on top of their existing feed-in tariff. The Reposit app alerts customers when and for how long their battery will be required to discharge, and what their payment will be.

**Source:** Reposit Power Pty Ltd, A Commercially Viable Application of Electricity Storage for Australia's National Electricity Grid – A Final Report, (part of the Australian Renewable Energy Agency Emerging Renewables Project), October 2016;

<https://repositpower.com/fleet/>;

<https://repositpower.com/gridcredits/>

## 4 Our approach for setting the draft benchmarks for solar feed-in tariffs

As Chapter 3 discussed, our approach for setting our draft benchmarks for solar feed-in tariffs in 2018-19, involves estimating the value of solar exports to retailers in 2018-19 by:

1. Forecasting the average wholesale electricity price on the NEM in 2018-19 using NSW baseload electricity futures contracts for this year traded on the Australian Stock Exchange (ASX), averaging the daily close price over 40 days, and then adjusting it down by 5% to reflect that contracts typically trade at a premium to spot prices.
2. Estimating then applying a 'solar multiplier' to adjust this forecast price to account for whether wholesale prices are likely to be higher or lower than this average price at the times when solar exports occur. We estimate the multiplier using historical data on wholesale prices and the timing of solar exports.
3. Estimating then applying a loss factor to the adjusted forecast wholesale electricity price to account for the electricity losses that retailers avoid paying for when they supply customers with other customers' solar exports.
4. Adding the value of the NEM fees and charges that retailers avoid paying when they supply customers with other customers' solar exports.

In deciding on this approach – which is largely the same as we have used in previous years – we considered a range of stakeholder comments. The sections below provide an overview of these comments, and then discuss our responses to explain why we have maintained our approach.

The next two chapters provide a more detailed explanation of steps 1 and 2 of our approach, and Box 4.1 below provides more detail on steps 3 and 4.

#### Box 4.1 How we calculate loss factors and NEM fees and charges

When retailers purchase electricity on the NEM, they must buy more than they supply to customers because some will be lost as the electricity flows along the transmission and distribution networks. However, when retailers supply solar exports, these losses don't occur because solar exports tend to be consumed close to where they are produced. This results in a saving (or avoided cost) for retailers.

To account for this cost, the third step in our approach for setting benchmark feed-in tariffs is to multiply our adjusted forecast average wholesale price (the result of steps 1 and 2) by a loss factor. We estimate this loss factor using loss factors published by AEMO. We weight the average loss factor for 2018-19 across the three distribution network areas in NSW, accounting for both transmission and distribution line losses. We include:

- ▼ *MLF*, which is transmission line losses between the Regional Reference Node and each bulk supply connection point for the coming financial year, weighted by actual energy consumption at each connection point, excluding industrial customers.
- ▼ *DLF*, which is distribution loss factors for small customers for the coming financial year, weighted by customers' actual consumption.

When retailers purchase electricity on the NEM they must pay NEM fees and charges. As they avoid this cost when they supply solar exports, the final step in our approach is to add the value of these fees and charges in the coming year to the result of step 3.

## 4.1 Overview of stakeholder comments on our approach

In submissions to our Issues Paper, some stakeholders were supportive of our overall approach. They supported the approach to set the benchmark range based on the savings that retailers are likely to make when they supply electricity from solar customers rather than purchase electricity from the NEM. This is because a retailer that sets its feed-in tariff above this will incur higher costs and eventually need to increase retail electricity prices or reduce the discount in market offers.

These stakeholders agreed with our approach to estimate the value of solar exports for the coming financial year using the average forward wholesale electricity price (based on NSW futures contracts), and then apply a 'solar multiplier' using historical data.<sup>35</sup> However, in our Terms of Reference, the NSW Government also asked us to consider forward-looking measures of wholesale prices when solar electricity is likely to be exported in estimating the value of solar exports.

In submissions to our Issues Paper, other stakeholders commonly argued that:

- ▼ feed-in tariffs should be higher, or the same as retail prices, or retailers will profit unfairly from solar customers,
- ▼ feed-in tariffs should include a subsidy to reflect the value of the environmental and health benefits that solar electricity provides to the broader community,

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<sup>35</sup> AGL submission to IPART Issues Paper, April 2018, p 1; Simply Energy submission to IPART Issues Paper, April 2018, p 1, Red Energy and Lumo Energy Australia submission to IPART Issues Paper, April 2018, p 2.

- ▼ setting feed-in tariff benchmark in line with (falling) wholesale electricity prices effectively punishes solar panel owners for their contribution in helping to reduce the wholesale power price for all consumers, and
- ▼ feed-in tariffs should also reflect the financial benefit to electricity network suppliers, particularly the potential to defer network investment.

## **4.2 Using historical data to adjust for when solar energy is exported is more accurate than modelling**

Our Terms of Reference specified that:

In conducting this investigation, IPART may incorporate forecasted electricity wholesale cost fluctuations instead of historical data.

This would involve modelling prices when solar electricity is likely to be exported, rather than our current approach of taking a forward measure of the **average** wholesale price, and using historical data to adjust the price for when solar energy is likely to be exported.

We considered this approach and decided to continue to use historical data to forecast price fluctuations throughout the day. We consider that this is the best way to account for patterns in wholesale electricity prices because it captures all the factors that contribute to price volatility, whereas market modelling relies on assumptions which can be incomplete. This approach was generally supported by stakeholders.<sup>36</sup>

## **4.3 Retailers do not profit unfairly from solar customers as they only avoid wholesale costs when they supply solar exports**

Under our approach, the benchmarks for solar feed-in tariffs largely reflect the forecast wholesale cost of electricity, not the retail price. This is because retailers only avoid the wholesale cost.

The retail price customers pay for the electricity retailers supply recovers a range of cost components, including:

- ▼ the wholesale costs of purchasing the electricity on the NEM, which include the wholesale price plus associated costs, fees and charges
- ▼ network costs, which retailers pay the network businesses for transporting the electricity to the customers' premises
- ▼ green scheme costs, including retailers' obligation to purchase renewable energy certificates (under the Commonwealth Renewable Energy Target) and energy savings certificates (under the NSW Energy Savings Scheme) in line with government environmental policies, and
- ▼ retail costs, which retailers incur in serving their customers, and which include costs related to billing, responding to customer inquiries, and complying with regulations.

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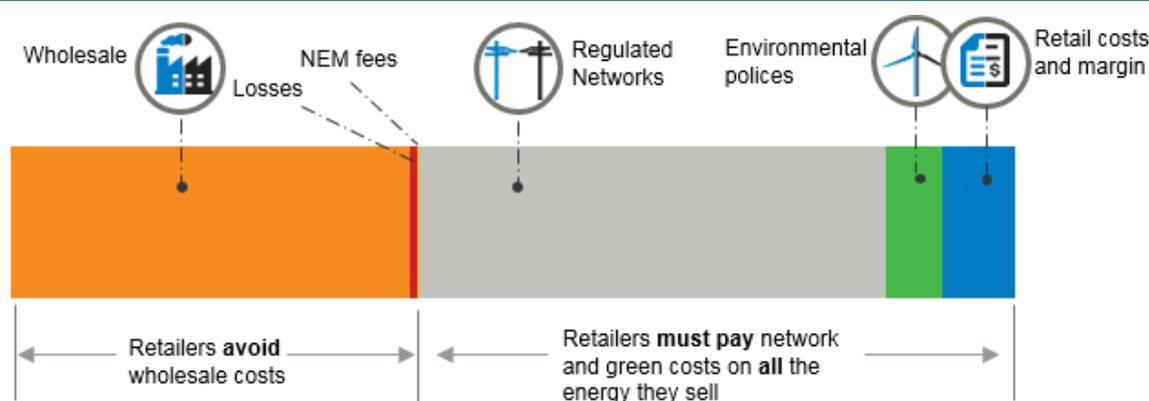
<sup>36</sup> For example, see Red Energy and Lumo Energy submission to IPART Issues Paper, April 2018, p 2; and Simply Energy submission to IPART Issues Paper, April 2018, p 1.

For each kWh that solar customers export to the grid, retailers avoid paying the wholesale costs of purchasing this electricity on the NEM. As Figure 4.1 shows, these wholesale costs typically make up around **30-40% of retailers' total costs**.

However, they still pay the other cost components. The metering and settlement arrangements in the NEM mean that retailers incur network and green scheme costs for every kWh of electricity they supply to a customer, **regardless of where and how the electricity was generated**. Thus they still pay these costs when they supply electricity from solar exports.

Retailers also incur costs in running their retail business (although unlike other costs, these depends more on the number of customers they have, rather than how much energy is exported).

**Figure 4.1 Cost components recovered in retail electricity prices, based on representative market offer price in NSW, 2017-18**



**Data source:** AEMC, *2017 Residential Electricity Price Trends*, Final Report, 18 December 2017, p 100.

Many stakeholders submitted that retailers are unfairly profiting from solar customers because they offer feed-in tariffs that are much lower than their retail charges.<sup>37</sup> For example one stakeholder argued that the price they were receiving for their solar exports was too low, and that exports were undervalued, as they had to buy electricity from their retailer for considerably more than the feed-in rate.<sup>38</sup>

However, this is simply not true. Retailers cannot sell the solar exported by their customers to other customers at little or no cost on top of any feed-in tariffs they pay.

Similarly, while many stakeholders submitted that retailers should be required to pay a feed-in tariff equal to the retail price of electricity ('1-for-1'), this would result in them making a substantial loss on solar exports. As a result, they would have to increase retail prices substantially to recoup this loss. We estimate that the loss would be equal to \$137 million state-wide over a year, which would add \$50 to the average annual household bill. Alternatively, they would choose not to supply these customers.<sup>39</sup>

<sup>37</sup> For example, see submissions to IPART Issues Paper from R. Naprta, April 2018, p 1; P. Stanhope, April 2018, p 1; and W. Brenton, April 2018, p 1.

<sup>38</sup> Submission to IPART Issues Paper from C. Jones, April 2018, p 1.

<sup>39</sup> Based on the consumption tariff (including discounts and excluding GST) for the median bill for a solar customer in the Ausgrid area for the average level of consumption and solar exports. See footnote 14 for information on our estimation methodology.

One stakeholder said that the metering and settlement arrangements in the NEM are unfair and should be changed.<sup>40</sup> These arrangements are governed by National Electricity Rules and so are outside the scope of this review.

#### 4.4 Requiring retailers to pay a higher feed-in tariff would increase bills for all customers

If we were to set benchmarks for solar feed-in tariffs higher than the financial value of customers' solar exports to retailers, as many stakeholders suggested, it is highly likely that retailers would simply ignore these benchmarks. As Chapter 1 noted, offering solar feed-in tariffs is voluntary for retailers, and our benchmarks provide guidance on what tariffs are appropriate and reasonable.

But even if retailers were **required** to offer a minimum feed-in tariff equal to our benchmark, we consider this benchmark should not exceed the financial value of solar exports to retailers. This is because setting tariffs higher than this value would result in:

- ▼ higher costs to retailers, which they would then need to recover from all customers, or
- ▼ retailers choosing not to supply solar customers, which would reduce competition for solar customers.

This would be contrary to our Term of Reference, which states:

In conducting this investigation the IPART is to consider the following key parameters:

- There should be no resulting increase in retail electricity prices.
- The benchmark range should operate in such a way to support a competitive market in NSW.

Climate Change Balmain-Rozelle submitted that one interpretation of our Terms of Reference is that the feed-in tariff should not contribute to retail electricity prices that are 'higher than if there were no PV feed-in'.<sup>41</sup> It suggested that the feed-in tariff should be set at the wholesale prices that **would have** occurred had solar not been exporting to the grid. However, we consider that it is clear from the Terms of Reference that the **benchmark** should not result in retail prices that are higher than what they otherwise would be.

For example, if we set the solar feed-in tariff at **15 c/kWh** (or double the forecast average wholesale value of solar across the day), we estimate that retailers costs' would be \$59 million higher a year across NSW compared to our benchmark feed-in tariff (where retailers' would incur no additional costs from paying customers for their exports instead of buying this electricity from the wholesale market). We have estimated that to recover these additional costs, the average annual household bill would need to increase by \$22.<sup>42</sup>

In effect, setting solar feed-in tariffs higher than our draft benchmark would result in households **without** solar panels paying higher electricity bills so that customers **with** solar could receive more for their solar exports. This would disproportionately affect the households who are unable to install a solar system (for example, because they rent or they cannot afford the upfront costs).

<sup>40</sup> Submission from D Robinson, 16 April 2018; p 1.

<sup>41</sup> Climate Change Balmain-Rozelle submission to IPART Issues Paper, April 2018, p 2.

<sup>42</sup> See footnote 14 for information on our estimation methodology.

We also note that currently, average annual bills for solar customers are an average of \$450 lower than customers without solar panels, **before** revenue earned from solar feed-in tariffs (see Box 4.2). This represents an ongoing saving to these customers after their payback period (which is currently approximately 6-8 years).

#### **Box 4.2 Bills for households with solar panels are significantly lower**

The average household bill for a solar customer with a 2-kW system is around \$1,550 per annum, compared to \$2,100 for households without panels. Solar customers can save around \$450 a year by using the solar energy they generate themselves (rather than purchasing it from their retailer), in addition to receiving any solar feed-in tariff from their retailer (an average of around \$100).

Solar customers also receive an upfront subsidy for installing their panels under the Small-Scale Renewable Energy Scheme. For a 2-kilowatt solar system installed in Sydney, the subsidy is currently worth around \$1,050 to \$1,330. After this subsidy, the upfront costs of a solar system are around \$3,400. The payback period for these upfront costs is around 6 years.

Following the payback period, the customer is able to make ongoing savings off their bills for the remaining life of the panels (around 19 years).

Even without any feed-in tariff, this customer would still pay off their panels in around 7.5 years. Similarly, if the upfront subsidy were removed, the payback period would be 8 years, with a remaining life after payback of almost 17 years.

**Note:** The values for financial incentives under the SRES assume the solar unit is installed in Sydney on 24 April 2018. The dollar range is based on certificate prices of \$30 and \$38. Assumes a solar panel life of 25 years.

**Source:** Clean Energy Regulator, *Small generation unit STC calculator*, <https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator>, accessed 24 April 2018; Green Electricity Markets, *STC Market Prices*, <http://greenmarkets.com.au/resources/stc-market-prices>, accessed 24 April 2018. Solar Choice, *Current Solar System Prices: Residential and Commercial*, <https://www.solarchoice.net.au/blog/solar-power-system-prices>, accessed 24 April 2018.

Most of the stakeholders who made submissions to our Issues Paper considered that solar feed-in tariffs should be higher than our preliminary estimate of 8.3 c/kWh. Our draft benchmark for all-day solar feed-in tariffs is lower than this, at 7.5 c/kWh, because it reflects the recent forward contract wholesale price from the ASX (less the contract premium), which has fallen from 8 c/kWh to 7.4 c/kWh since we released our Issues Paper.

#### **4.5 Customers already receive a subsidy for the external benefits of solar when they install a solar system**

A large number of stakeholders, mostly individual owners of solar panels, submitted that the solar feed-in tariff should be higher to reflect the environmental and health benefits that all solar electricity generation provides to the broader community.<sup>43</sup> Some stakeholders noted that the Essential Services Commission is required to include a value for avoided social costs of 2.5 c/kWh when it sets feed-in tariffs for Victorian solar customers.<sup>44</sup>

We have not included a value for environmental, health benefits or other externalities in the benchmark range for two main reasons. First, the subsidies that customers receive under the Australian Government's Small-Scale Renewable Energy Scheme take account of

<sup>43</sup> For example, see submissions to IPART Issues Paper from J. Scarborough, April 2018; p 1, I. Noakes, April 2018, p 1.

<sup>44</sup> For example, see submissions to IPART Issues Paper from P. Youll, April 2018, p 1, R. Cace, April 2018, p 1.

community wide benefits of clean renewable energy (Box 4.3). On average, all NSW households pay around \$15 each year through their bills to fund the Small-Scale Renewable Energy Scheme subsidy.<sup>45</sup>

Second, retailers don't capture avoided externalities associated with solar energy. If a value for these benefits were included in feed-in tariffs, retailers would need to recoup this amount from their customers (including those without solar panels) through higher retail prices.

#### **Box 4.3 Financial incentives under the Small-Scale Renewable Energy Scheme**

The aim of the Small-Scale Renewable Energy Scheme is to reduce emissions of greenhouse gases and encourage the additional generation of electricity from sustainable and renewable sources. This scheme works by allowing the owners of small-scale systems to create small-scale technology certificates for every megawatt hour of electricity they generate. Certificates are then purchased by electricity retailers and submitted to the Clean Energy Regulator to meet the retailers' legal obligations under the Renewable Energy Target. This creates a market which provides financial incentives to the owners of small-scale renewable energy systems.

Small-scale technology certificates can be created following the installation of an eligible solar system and are calculated based on the amount of electricity a system produces or replaces (that is, electricity from non-renewable sources). Generally, households who purchase an eligible solar system assign the certificates to an agent in return for a lower purchase price.

For example, the financial incentive under the Small-Scale Renewable Energy Scheme is currently worth around:

- ▼ \$1,050 to \$1,330 for a 2 kW solar unit
- ▼ \$1,590 to \$2,014 for a 3 kW solar unit
- ▼ \$2,670 to \$3,382 for a 5 kW solar unit

Financial incentives under the Small-Scale Renewable Energy Scheme are gradually being phased out over the period 2017 to 2030.

**Note:** The examples above assume the solar unit is installed in Sydney on 24 April 2018. The dollar range is based on certificate prices of \$30 and \$38.

**Source:** Clean Energy Regulator, <http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target>, accessed 3 May 2018; Small generation unit STC calculator, <https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator>, accessed 3 May 2018; Deeming period decline, <http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Agents-and-installers/deeming-period-decline>, accessed 3 May 2018.

<sup>45</sup> AEMC, *2017 Residential Electricity Price Trends*, Final Report, 18 December 2017, p 100.

## 4.6 Customers should be paid the market value for the electricity they generate

Solar generation has contributed to reduced demand for electricity from retailers during daylight hours, which has contributed to lower prices during these times. Under our approach, the solar feed-in benchmark falls in line with wholesale costs, to reflect the lower savings to retailers that they make when they supply their customers using solar exports.

However, many stakeholders argued that reducing the solar feed-in tariff benchmark would be effectively punishing solar panel owners for their contribution in helping to reduce the wholesale power price for all consumers. For example, stakeholders submitted that:

Rooftop solar has reduced the wholesale price of power for everyone. This is even more of a reason to pay solar owners a fair price, not punish people who've done the right thing.<sup>46</sup>

It is laughable that IPART would blame household generated electricity for lowering the price of electricity and punish them by lowering the feed-in tariff! Surely it is a good thing to have lower electricity prices and we should look elsewhere for the party or parties to blame for the high price of electricity.<sup>47</sup>

Similarly, other stakeholders argued that because solar exports have contributed to the lower wholesale prices upon which our solar feed-in benchmark is based, that solar customers should receive some of this benefit,<sup>48</sup> or that it should be 'cushioned' against the falling wholesale price.<sup>49</sup> Sunny Shire submitted that:

Rooftop solar is already reducing wholesale electricity prices. Feed-in tariffs should also reflect this impact, and take into account future high prices when Liddell closure happens in 2022, if more investment in energy generation does not occur.<sup>50</sup>

However, any new generator (or new customer) entering or exiting the electricity market would change the balance of supply and demand, and thus could lead to lower or higher wholesale electricity prices. Such a generator (or customer) would not be compensated for this impact. For example, a new generator that contributes to a reduction in wholesale spot prices does not receive any additional payment to reflect the lower wholesale price. It takes the same market price as all other generators, and so all customers benefit from the price reduction. Likewise, a customer who consumes electricity by switching on an appliance and thereby increasing the market demand for electricity, and electricity prices for all customers, is not required to compensate other customers for these higher prices. These are just normal outcomes of a competitive market.

In our view, solar customers should be treated like any other generator in the competitive market. As mentioned previously, there are other policies specifically designed to encourage more investment in solar panels, such as the Small-Scale Renewable Energy Scheme.

<sup>46</sup> Submission to IPART Issues Paper from D. Humphries, April 2018, p 1.

<sup>47</sup> Submission to IPART Issues Paper from A. Jacobs, April 2018, p 1.

<sup>48</sup> For example, see submissions to IPART Issues Paper from G. Lockhart, April 2018, p 1, J. Tager, April 2018, p 1, L Johnson, March 2018, p 2.

<sup>49</sup> Submission to IPART Issues Paper from, P. Keig, April 2018, p 1.

<sup>50</sup> Submission to IPART Issues Paper Sunny Shire, April 2018, p 2.

## 4.7 Solar exports are not likely to provide system-wide net benefits for networks

Many stakeholders called for feed-in tariffs to include a value for the benefit that solar provides to the electricity network, particularly the potential to defer investment in the networks.<sup>51</sup>

Because retailers do not capture any value associated with benefits to the networks, our view is that such a payment would need to be made from the networks (rather than retailers) to customers.

However, when this issue was considered by the Australian Energy Market Commission (AEMC) in 2016, it decided not to introduce payments from networks to customers because it found that even in areas where there was projected network congestion, payments to embedded generators (like solar) can increase costs to consumers while offering little or no deferral of network investment. The analysis showed that any benefit from additional embedded generation as a result of introducing a network credit scheme would be far outweighed by the costs of the scheme.<sup>52</sup> The analysis also showed solar combined with batteries had a limited additional effect on deferring network investment, and that the benefit is still outweighed by the cost.<sup>53</sup>

This is consistent with our findings. Frontier Economics provided expert advice to IPART about whether this is the case. It found that solar exports are unlikely to contribute to meeting peak demand on the distribution and transmission networks, and therefore are unlikely to defer network costs. It reported that across the distribution networks, solar exports are likely to make only a small contribution (relative to their capacity) to meeting peak demand on the network in summer, and are likely to make no contribution to meeting peak demand in winter. This is because in winter peak demand occurs after the sun has set.<sup>54</sup> When solar exports do contribute to reducing peak demand this may not result in any material cost saving from avoided or deferred network investment in the short term, due to the spare capacity on much of the network.<sup>55</sup>

In addition, solar exports may impose costs on the distribution network, such as investments to support bi-directional flows of electricity to handle the volume of solar exports.<sup>56</sup>

Further analysis and discussion of network benefits and costs can be found in Frontier's report.<sup>57</sup>

We also considered whether the solar feed-in tariff benchmark should include a value for avoided transmission usage charges because solar exports are not transported through the transmission networks. But as section 4.3 explained, under the existing metering arrangements, retailers are billed for network charges (the transmission charges are included in the distribution charges) on all electricity that they supply to their customers, regardless

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<sup>51</sup> For example, see submissions from D, Robinson, April 2018, p 1.

<sup>52</sup> AEMC, *Local Generation Network Credits, Final Rule Determination*, December 2016, pp vi-vii.

<sup>53</sup> *Ibid*, p 34.

<sup>54</sup> Frontier Economics, *2018 Solar Feed-in Tariff Review – A Final Report prepared for IPART*, March 2018, p 30.

<sup>55</sup> *Ibid*, p 31.

<sup>56</sup> *Ibid*.

<sup>57</sup> *Ibid*, Section 7.



of its source. Because retailers do not receive any transmission-related savings when individual customers export solar electricity, including a value for avoided transmission costs would mean that retailers would pay more for solar exports than for purchasing electricity on the NEM, and they would have to recoup this cost from their remaining customers.

## 5 How we forecast the average wholesale electricity price

As Chapter 4 set out, the first step in our approach for setting benchmark solar feed-in tariffs for 2018-19 was to estimate the forecast average wholesale electricity price on the NEM for the year. As in previous years, this step involved:

- ▼ sourcing publicly available price data from NSW baseload electricity futures contracts for this year traded on the Australian Stock Exchange (ASX),
- ▼ averaging this data over 40 trading days as at 18 April 2018 (to be updated for our final report to 15 May 2018), and
- ▼ adjusting this average price down by 5% to reflect that contracts typically trade at a premium to spot prices.

The sections below provide an overview of our draft forecast, and then discuss each part of the step in more detail.

### 5.1 Overview of draft forecast average wholesale electricity price

For this Draft Report, we forecast that the average wholesale electricity price for 2018-19 is around 7.4 c/kWh (Table 5.1). This is lower than our forecast for our Issues Paper of 8 c/kWh. It is also substantially lower than our final forecast for 2017-18 of 11 c/kWh.

**Table 5.1 Forecast average wholesale price for 2018-19 compared to 2017-18 (c/kWh)**

	2017-18 (Final)	2018-19 (Draft)
<b>Forecast average wholesale price</b>	11	7.4

**Note:** As of 18 April 2018. Includes a 5% contracting premium.

**Data source:** Data from Thomson Reuters Eikon.

According to the AEMC's 2017 Residential Electricity Price Trends report:

The trend in wholesale costs in 2018/19 and 2019/20 is downwards and is driven by:

- approximately 4,100 MW of new committed and expected (modelled) generation entering the NEM in 2018/19 and 2019/20.
- the return to service of the Swanbank E gas power station (385 MW) in early 2018
- reduced short-run costs for South Australian gas plants in 2019/20 due to the pass through of certificate revenue related to the Energy Security Target.<sup>58</sup>

<sup>58</sup> AEMC 2017 Residential electricity price trends Final Report, December 2017, page 19.

## 5.2 Sourcing publicly available price data

As in other years, we prefer to use publicly available data to forecast the average wholesale price. We consider the baseload futures contracts published quarterly by the ASX are the best source of publicly available data on future wholesale electricity prices. These are contracts to trade a fixed amount of electricity for a certain price at all times of the day over a future quarter. They represent the market's view of **average** wholesale electricity spot prices for that quarter. Most trade and liquidity in these contracts is around 12-24 months out<sup>59</sup> and, as they are exchange-traded and publicly reported, there is more price transparency relative to trades that occur on a confidential basis directly between counterparties.

### 5.2.1 Averaging this data over 40 trading days

As in previous years, we have used a 40-day average of electricity futures contract prices. This approach is also consistent with how we estimated energy purchase costs when we regulated retail electricity prices, and the approach we currently use to determine market-based weighted average cost of capital (WACC) parameters.

In past reviews some stakeholders submitted that using a short averaging period can result in a material misestimate, especially during periods of price volatility. They submitted that in practice, energy retailers contract for their load in increments over a longer period of time, potentially up to three years, and make adjustments as the expected customer load they need to serve changes.

We acknowledge that the length of the averaging period can have a large impact on the resulting forecast price.

Figure 5.1 shows the:

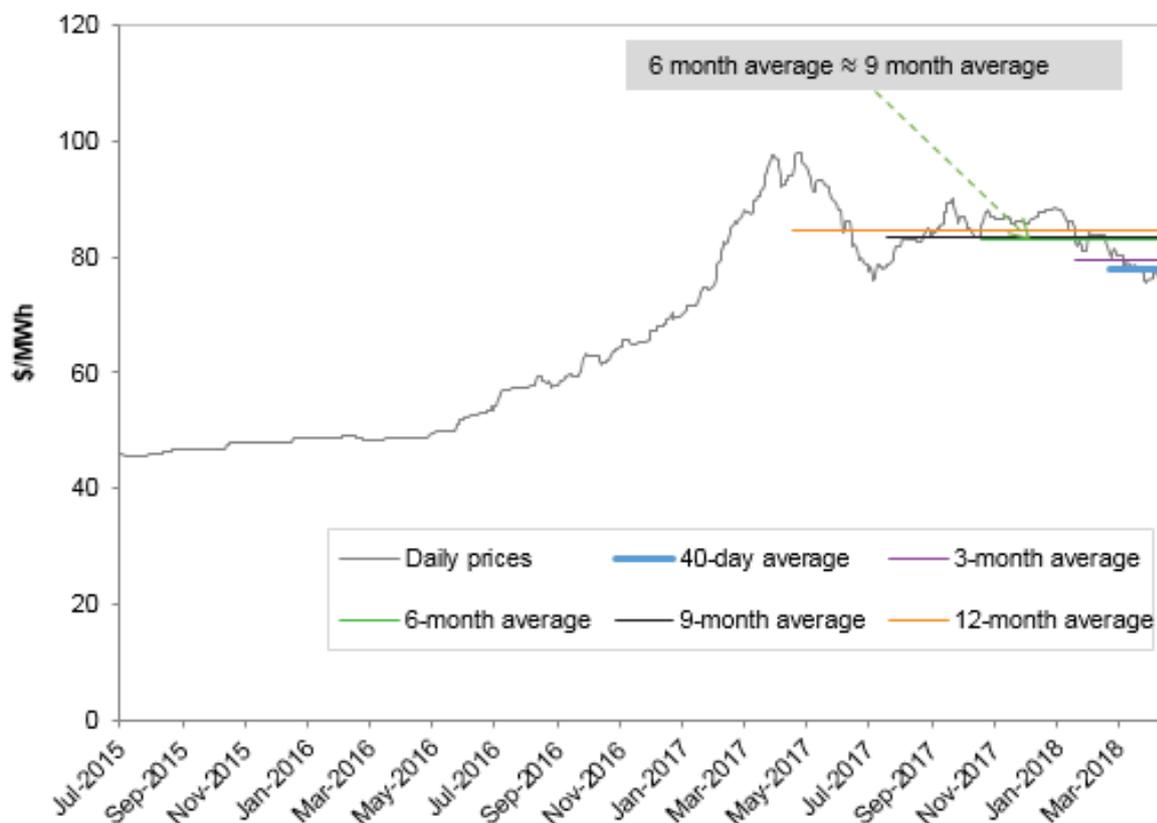
- ▼ 40-day average until 18 April (used as a basis for the draft benchmark range)
- ▼ 3-month average from 18 January 2018 to 18 April 2018
- ▼ 6-month average from 18 October 2017 to 18 April 2018, and
- ▼ 12-month average from 18 April 2017 to 18 April 2018.

It indicates that averaging the daily electricity futures contract prices over a longer time period leads to a higher forecast wholesale cost.

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<sup>59</sup> Australian Energy Regulator, *State of the Energy Market 2017*, May 2017, p 60.

**Figure 5.1 Forecast average wholesale electricity prices for 2018-19 using different averaging periods**



**Note:** Averages are calculated as of 18 April 2018, and include a 5% contracting premium.

**Data source:** Data from Thomson Reuters Eikon.

This figure also shows that NSW electricity futures contract prices for 2018-19 have fallen substantially over the last year. Since peaking at almost \$100 in March 2017, prices stabilised at around \$85-\$90 for the second half of 2017, before steadily declining to \$73 in April 2018. Given this trend, using a longer averaging period would have a substantial impact on the forecast price for 2018-19. As at 18 April 2018, the 3-month and 6-month average prices are \$79.53/MWh and \$83.14/MWh, respectively.<sup>60</sup>

<sup>60</sup> Data from Thomson Reuters Eikon.

Nevertheless, we consider our current approach for forecasting average wholesale electricity prices remains appropriate. This approach is based on a 'mark-to-market' (or 'point-in-time') approach, which we have consulted on over a number of years. A point-in-time approach is based on the principles of setting prices that reflect outcomes in a competitive market. In particular, a point-in-time approach reflects that:

- ▼ Economic decisions should be based on the current value of assets, rather than their historic value.
- ▼ The extent to which retailers have entered into contracts in the past that are either cheaper or more expensive than today's contract prices are sunk costs. A competitive market would not allow a retailer to recover the costs of 'out of the money' contracts.
- ▼ Retailers' decisions around what retail price to offer customers should reflect expectations of the cost of supplying that customer and not the consequences of prior decisions.

While in practice retailers may purchase contracts over a longer period of time, our approach is consistent with above principles.

### **5.3 Adjusting to reflect the contract premium**

ASX futures contract prices typically trade at a premium to underlying spot prices. Because we are interested in wholesale electricity spot prices in the coming financial year, we need to make some adjustment to average contract prices. However, the contract premium cannot be directly observed. We have assumed contract premium of 5%, consistent with the approach taken in previous years. We also used this same assumption when we regulated retail electricity prices.

We have received expert advice from Frontier Economics that 5% continues to be a reasonable assumption based on its recent analysis.<sup>61</sup>

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<sup>61</sup> Frontier Economics, *2018 Solar Feed-in Tariff Review – A Final Report prepared for IPART*, March 2018, p 15.

## 6 How we estimated the solar multiplier

As Chapter 4 discussed, the next step in our approach for setting our draft benchmark solar feed-in tariffs for 2018-19 was to multiply our forecast average wholesale electricity price by a 'solar multiplier'. To estimate this multiplier, we:

- ▼ used the same modelling approach as we have in previous years
- ▼ used the latest 3 years of historical data (2014-15 to 2016-17) in this model in response to a sustained shift when high wholesale prices occur in the market
- ▼ continued to use data from Ausgrid's area of operation only.

The sections below provide an overview of our draft solar multiplier, and then discuss each part of the step in more detail.

### 6.1 Overview of the draft solar multiplier for 2018-19

Our draft estimate of the solar multiplier across the whole day is 0.99, which means that we forecast that the value of solar exports will be around the same as the average wholesale price of electricity.

Our draft estimate of the solar multiplier is lower than for previous years. For example, for 2017-18, we estimated a solar multiplier of 1.14, which meant that the value of solar exports would be 14% higher than the average wholesale price across the day.

Our draft estimate reflects that in recent years, wholesale electricity prices have been relatively lower during daylight hours compared to the average price. This is largely because the demand for electricity from the National Electricity Market (NEM) is lower during these hours because a proportion of total demand is being met by solar generation.

### 6.2 We used the same modelling approach as previous years

We have estimated the solar multiplier as the ratio of the solar output-weighted wholesale electricity price to the time-weighted wholesale electricity price, where:

- ▼ the solar output-weighted electricity price is the average price across the year weighted by how much solar is exported at the time, and
- ▼ the time-weighted electricity price is the arithmetic average price across the year.

The solar output-weighted price is calculated by taking the spot price in each of the 17,520 half hours in the year (48 per day, 365 days a year), multiplying each price by the proportion of exports that occurred in that half hour, and summing the result. The time weighted price is simply the average price across those 17,520 half hours in the year.

Box 6.1 shows a stylised example of this calculation.

### Box 6.1 Stylised example of how we calculate the solar multiplier

Assume that the spot price is set in the electricity market four times across the day, and there are only three days in a year, so that there are only 12 prices in the year. The first spot price that occurs each day is for the morning, the second is for the afternoon (when the majority of exports occur), the third is in the evening (when exports are very low), and the fourth is at night (when the solar exports are negligible).

The first two days in this example are sunny days, and the third is cloudy (and so the proportion of exports over this day is lower).

		Price	Proportion of exports	Price x proportion of exports
Day 1	Spot price 1 (morning)	\$60	15%	\$9
	Spot price 2 (afternoon)	\$80	20%	\$16
	Spot price 3 (evening)	\$200	0.5%	\$1
	Spot price 4 (night)	\$50	0%	\$0
Day 2	Spot price 5 (morning)	\$50	16%	\$8
	Spot price 6 (afternoon)	\$150	25%	\$38
	Spot price 7 (evening)	\$150	0.5%	\$1
	Spot price 8 (night)	\$40	0%	\$0
Day 3	Spot price 9 (morning)	\$90	8%	\$7
	Spot price 10 (afternoon)	\$100	14%	\$14
	Spot price 11 (evening)	\$120	0.5%	\$1
	Spot price 12 (night)	\$50	0%	\$0
<b>Solar exported weighted price</b>			100%	<b>\$94</b>
<b>Average (time-weighted price)</b>		<b>\$95</b>		
<b>Solar multiplier (solar weighted price / average price)</b>				<b>0.99</b>

Source: IPART

As we have done in our previous reviews, we have used a simulation process based on the Monte Carlo method to estimate the solar multiplier, using historical half-hourly spot prices in the NEM for NSW and half-hourly solar export data. This method generates 5,000 'synthetic years' and calculates a solar multiplier for each 'synthetic year.'

The purpose of using the Monte Carlo method is to generate a distribution of solar multipliers and identify the range of possible outcomes and the probabilities they will occur using the probability distribution. By using a range of possible values, instead of a single estimate, we can create a more realistic picture of what might happen in the future. Like any forecasting model, the simulation only represents probabilities and not certainty.

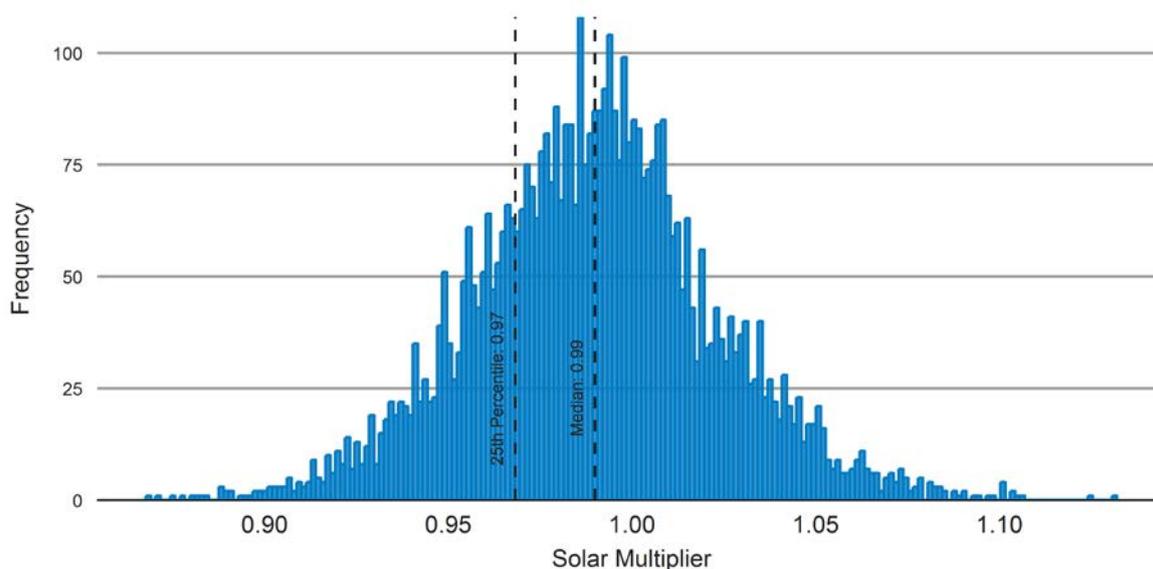
To generate each synthetic year, we randomly pick comparable days from previous years of data for 365 days to make up the year. For example, using three years of historical data, a synthetic year could be made up of 100 days from year 1, 200 days from year 2, and 65 days

of year 3. Comparable historical days must be for the same day name and from the same quarter. For example, a Monday in January in the synthetic year could come from any Monday between January and March from the historical data, and a Saturday in August could come from any Saturday between July and September.

For each ‘synthetic year’ there will be 17,520 spot prices for each hour, and the proportion of solar exports for each half hour (with the total exports adding to 100% for the synthetic year).<sup>62</sup> To calculate the solar output-weighted electricity price for that year, the spot price for each half hour in that year is multiplied by the proportion of solar exports that occurred in that half hour, and the result is summed. This is divided by the average spot price in that year to calculate the solar multiplier.

Because we do this 5,000 times (once for each synthetic year), we can generate a distribution of the solar multipliers for each synthetic year. Figure 6.1 shows the distribution of solar multipliers for the 5,000 synthetic years when we used historical price and export data between 2014-15 to 2016-17. It shows that **the median solar multiplier from this distribution was 0.99** - for around 50% of the synthetic years, the solar multiplier was less than 0.99, and for 50% of the synthetic years it was greater than 0.99.

**Figure 6.1 Example distribution of solar multipliers (Ausgrid data 2014-15 to 2016-17)**



Data source: IPART

We would set the solar multiplier equal to the median if we consider that the input data is not likely to inherently understate or overstate the results. Otherwise we can choose another point on the distribution. For example, in previous years we set the solar multiplier based on the 25<sup>th</sup> percentile because we considered that prices for several years that were included in the historical set (2009-10 and 2010-11) were unusually high in the middle of the day compared to other years, and market evidence suggested that these prices would be unlikely

<sup>62</sup> For each half hour, we use the total (or average) solar exports in kilowatt hours for each of the 500 customers in the sample. The total exports for the 500 customers adds to different amounts each year, but for our modelling, we normalise each year to 1 GWh per annum. This is because some years comprising the sampling pool could have more solar electricity exported than other years – for example, due to weather conditions.

to reoccur. This meant that a median solar multiplier calculated from this data would overstate the likely solar multiplier for future years.<sup>63</sup>

Solar multipliers can also be calculated for discrete time periods across the day (for example for any two-hour period). We can do this by dividing the average price in the discrete period (weighted by solar output) by the average price across all periods in the day.

### 6.3 We used the last three years of historical data

In selecting the historical data that we use in our Monte Carlo modelling, we firstly considered whether future years will continue to be like previous years. We found that there has been a sustained shift when high wholesale prices occur in the market, which makes it unlikely that our full eight-year historical wholesale price and solar export data set from 2009-10 to 2016-17 is the best estimate of this relationship for 2018-19.

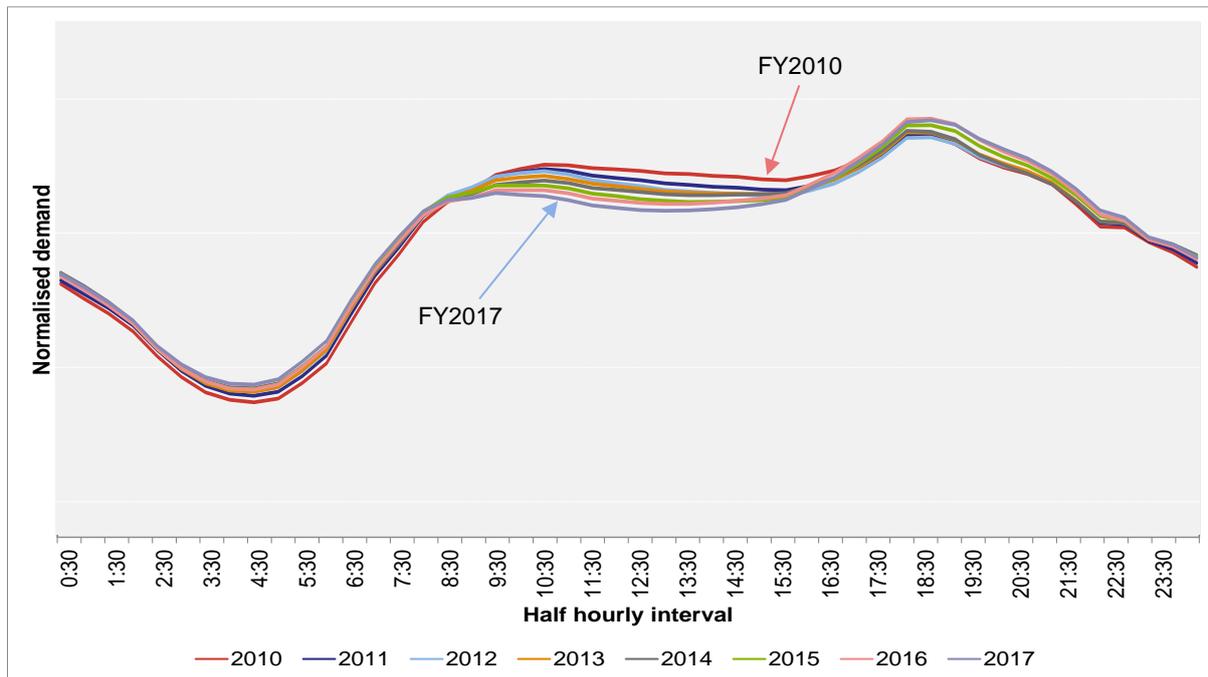
Demand has fallen during daylight hours, due to increased penetration of solar systems. Around 13% of all households in NSW (around 350,000 households in total) now have solar panels.<sup>64</sup> Figure 6.2 shows that in the middle of the day, demand has progressively reduced during daylight hours between financial years 2010 and 2017. As a result of this falling demand, wholesale prices have not peaked in the afternoon since 2009-10 and 2010-11, reducing the value of solar energy compared to the average price.

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<sup>63</sup> IPART, *Solar feed-in tariffs - The subsidy-free value of electricity from small-scale solar PV units in 2015-16*, Final report, October 2015, p 2.

<sup>64</sup> Based on information from the networks on number of solar customers, and ABS 2016 Census data and New South Wales Department of Environment and Planning for number of households (4% growth assumed since 2016 based on average annual growth 2016-2021). See ABS, '2016 New South Wales (STE) Community Profile', cat. No 2001.0, Table G32, <http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20Census%20Community%20Profiles>; <http://www.planning.nsw.gov.au/Research-and-Demography/Demography/Population-projections>.

**Figure 6.2 Average daily demand shape in NSW for 2009-10 to 2016-17**



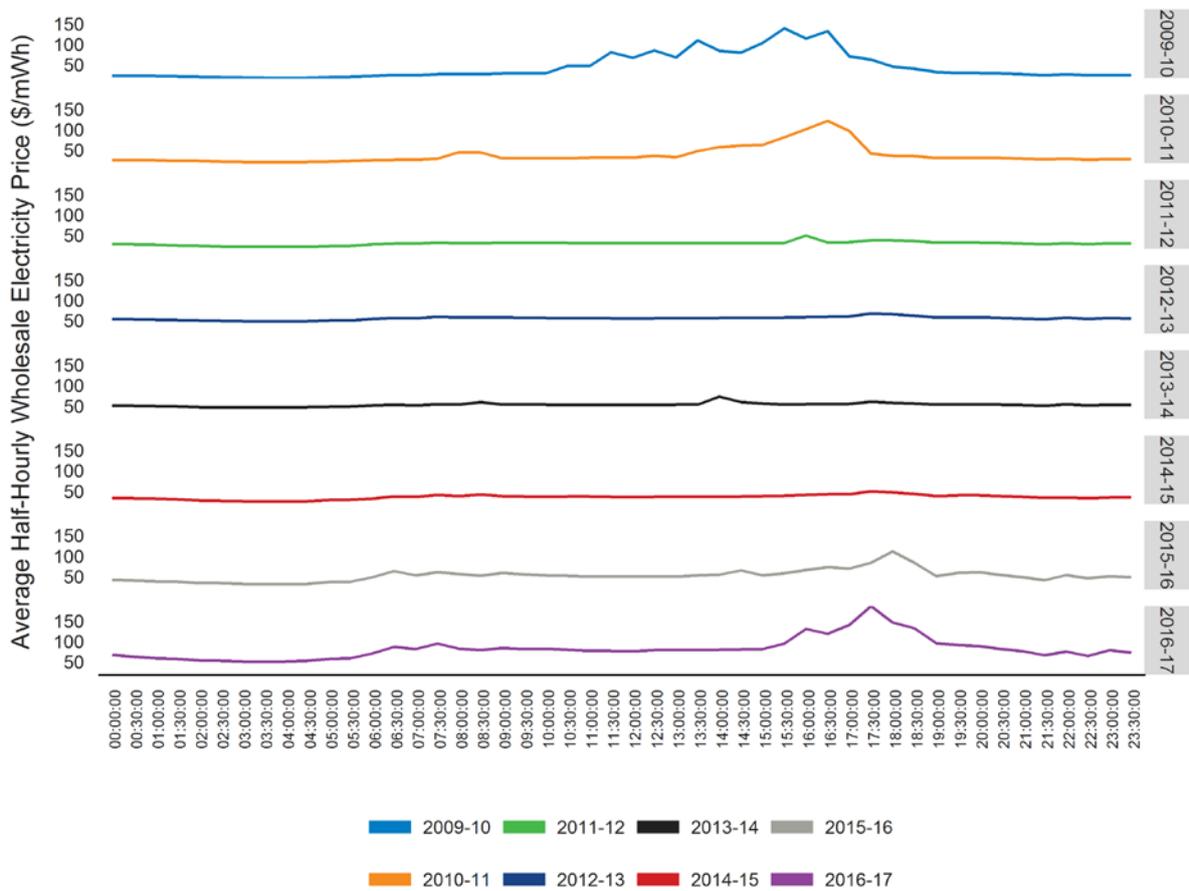
**Note:** Data has been normalised to keep the **total** output in each year constant to show the shift in *when* electricity is being consumed.

**Data source:** Frontier Economics, 2018 Solar Feed-in Tariff Review – A Final Report prepared for IPART, March 2018, p 19.

At the same time the demand-supply balance has tightened in the evening peak. This has become particularly pronounced with the withdrawal of Hazelwood in March 2017. As a result, higher cost gas-fired peaking plant sets wholesale prices more regularly during the late afternoon peak, causing price spikes during this time. This contrasts with the very low levels of price volatility between 2012-13 and 2014-15. As a result of this shift, the value of solar exports in the late afternoon is substantially higher relative to the average price.

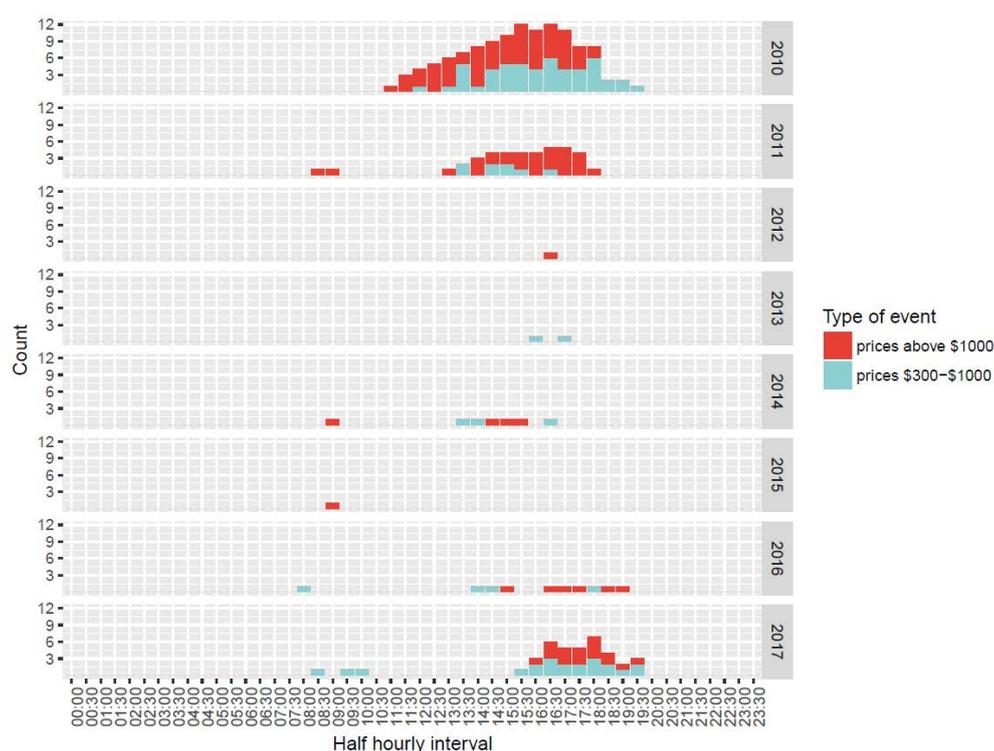
The impact of the sustained shifts when high wholesale prices occur can be seen in Figure 6.3 and Figure 6.4. They show that prices in the middle of the day have fallen relative to other times, while prices in the late afternoon have increased significantly.

**Figure 6.3 Average price by time of day in NSW (2009-2010 to 2016-17) (\$ nominal)**



Data source: IPART, based on AEMO data.

**Figure 6.4 High price events in NSW for 2009-2010 to 2016-17 (\$ nominal)**



**Data source:** Frontier Economics, *2018 Solar Feed-in Tariff Review – A Final Report prepared by IPART*, March 2018, p 25.

We also considered stakeholder comments on our Issues Paper. AGL submitted that it agrees with IPART’s assessment of the key drivers of the wholesale market such as the exit of Hazelwood, high gas prices, and the uptake of solar panels.<sup>65</sup>

AGL also recommended that the data used should be no more than 5 years old, as recent changes in the wholesale market means the use of older data is unlikely to be representative of future patterns.<sup>66</sup> Sunny Shire also argued that the use of historical data may not provide an accurate view of wholesale electricity price patterns, given rapid changes in the electricity generation market.<sup>67</sup> However, Simply Energy recommended the inclusion of data from 2011 onwards (using the 25<sup>th</sup> percentile) as this would represent the best estimation of conditions for modelling purposes.<sup>68</sup>

Overall, we concluded that that the supply conditions in 2018-19 are likely to be most similar to 2016-17 (the most recent year of data). In particular, the exit of Hazelwood has tightened demand-supply conditions, affecting prices in the evening, and this is likely to continue into 2018-19 (although new generation capacity entering the market in 2018-19 may start to put some downward pressure on evening peak wholesale prices).

However, supply is not the only determinant of wholesale prices. Factors such as weather can have a significant impact on demand (and therefore wholesale prices), and can fluctuate from year to year. Other one-off events such as power plant outages may also be inconsistent between years, and so are more accurately captured with several years of data.

<sup>65</sup> AGL submission to IPART Issues Paper, April 2018.

<sup>66</sup> *Ibid*, p 1.

<sup>67</sup> Sunny Shire submission to IPART Issues Paper, April 2018, p 2.

<sup>68</sup> Simply Energy submission to IPART Issues Paper, April 2018, p 1.

Therefore, to balance these supply and demand factors, for our draft benchmarks we decided to calculate the solar multiplier using the Monte Carlo simulation separately for:

- ▼ the most recent year of data (2016-17),
- ▼ the most recent two years of data (2015-16 to 2016-17), and
- ▼ the most recent three years of data (2014-15 to 2016-17).

Table 6.1 shows the feed-in tariffs using the solar multipliers calculated with each of these historical data sets. As discussed in Chapter 3, it shows that the all-day feed-in tariff is the same, regardless of which of the most recent three historical data sets is used. Table 6.1 also provides the results for the longer historical data sets.

We don't consider that the results from the Monte Carlo modelling would inherently overstate or understate the relationship between the prices when solar is exporting compared to the average price across the day, and therefore we have chosen the midpoint of the distribution from the results of the Monte Carlo modelling as the solar multiplier. However as shown in Table 6.1, there is very little variation in the all-day tariffs across the distribution of results. Therefore the results are almost the same regardless of the point in the distribution chosen.

**Table 6.1 Feed-in tariff by data sets and distribution**

	25 <sup>th</sup>	Median	75 <sup>th</sup>
<b>All-day</b>			
FY10-17	8.0	8.6	9.3
FY12-17	7.5	7.6	7.8
FY15-17	7.3	7.5	7.6
FY16-17	7.2	7.4	7.5
FY17	7.3	7.5	7.7

**Data source:** IPART modelling.

Table 6.2 shows the feed-in tariffs for the time-dependent ranges. Unlike the all-day tariffs, there is substantial variation in the results depending on the period that we model. Therefore we have provided a range for the time-dependent results based on the highest and lowest values across the three historical data sets.

**Table 6.2 Time-dependent benchmark ranges by historical periods**

Time window	2014-15 to 2016-17	2015-16 to 2016-17	2016-17
6:30 am – 3:30 pm	7.2	7.0	6.9
3:30 pm – 4:30 pm	8.9	9.2	11.7
4:30 pm– 5:30 pm	11.3	12.1	13.3
5:30 pm – 6:30 pm	12.8	15.9	20.9
6:30 pm – 7:30 pm	9.2	9.6	8.7
7:30 pm – 8:30 pm	8.5	8.5	8.4

**Data source:** IPART modelling.

## 6.4 We used Ausgrid data on solar exports only

In our previous reviews, we estimated the value of solar electricity at the time it is exported based on the solar export profile of a random sample of 500 Ausgrid solar customers (which covers Newcastle and most of Sydney). Neither the Endeavour network (in greater Western Sydney and Wollongong), nor the Essential network (which covers the rest of NSW) had a sufficient number of solar customers with digital meters installed to provide a representative sample of solar exports.

However, as more digital meters have been installed in the Essential and Endeavour networks, for the first time we have been able to collect a sample of 500 customers' half-hourly solar export data from these network areas for 2016-17. In addition, our Terms of Reference specified that we may incorporate half-hourly solar export data reflecting customers in all three network areas. Further, in response to our Issues Paper, Simply Energy notes that customers in the Essential Energy and Endeavour Energy network areas may have very different characteristics, and we should model the solar multiplier to include all networks. It submitted that this would align the calculation more closely to the way energy is exported in a greater number of network regions and so would result in a more indicative picture of actual solar output.<sup>69</sup>

We agree with Simply Energy that solar exports could exhibit different patterns given their geographic locations, and bigger PV unit sizes, particularly in the Essential Energy network area. Because of this variation, it would be ideal to include data from all three network areas in our modelling of the solar multiplier.

However, at present, we consider the Ausgrid network remains the best available source for half-hourly PV exports. While we have received data from the other networks, our view is that we need more than one year of data to ensure that the data provided is representative. It is not currently possible to assess whether or not the solar export profiles of Endeavour and Essential customers are 'typical' of those networks' areas, and using them runs the risk of relying on an outlier year to forecast for next year. AGL agreed that one year of data is not sufficient for modelling purposes, and suggested that at least three years of data will be necessary to provide a more robust result.<sup>70</sup> Simply Energy also considered that the inclusion of three years' data from the Essential Energy and Endeavour Energy networks would provide a relevant representation of the solar generation patterns in these areas.<sup>71</sup>

We will continue to collect data on half-hourly solar PV exports from all three network areas, and incorporate the data into our modelling when we are satisfied that the data is representative.

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<sup>69</sup> Simply Energy submission, April 2018, p 1.

<sup>70</sup> AGL submission to IPART Issues Paper, April 2018, p 2.

<sup>71</sup> Simply Energy submission to IPART Issues Paper, April 2018, p 1.

## A Terms of Reference

The investigation and determination by the IPART on annual benchmark range for feed-in tariffs for the next three financial years (FY2018-19, FY2019-20 and FY2020-2021)

### Reference to the IPART under section 9 of the Independent Pricing and Regulatory Tribunal Act 1992

With the approval of the Hon. Gladys Berejiklian MP, Premier of NSW and Minister administering the Independent Pricing and Regulatory Tribunal Act 1992 (IPART Act), pursuant to section 9(2) of the IPART Act, the Independent Pricing and Regulatory Tribunal (IPART) will enter into arrangements with the Department of Planning and Environment (the Department), for investigation and report, the determination of:

- The voluntary benchmark range for solar feed-in tariffs paid by retailers for electricity produced by complying generators and supplied to the distribution network.
- Time dependent benchmark ranges paid by retailers for electricity produced by complying generators and supplied to the distribution network during different times of the day.

### Conduct of investigation

In conducting this investigation, the IPART is to consider the following key parameters:

- There should be no resulting increase in retail electricity prices; and
- The benchmark range should operate in such a way as to support a competitive electricity market in NSW.

In conducting this investigation, IPART may incorporate;

- Half-hourly solar export data reflecting customers in all three network areas; and
- Forecasted electricity wholesale cost fluctuations instead of historical data.

### Reporting

The IPART is to report the feed-in tariff offered by each retailer at the time of writing its report and to note whether that tariff was within the benchmark for the preceding financial year.

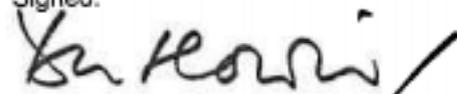
### Consultation

In making its determination on the benchmark range, IPART may consult on any matter that it regards as material.

### Timing

The IPART is to provide its determination by 30 June of each year for the next three years starting from 2018. The Department may amend the Terms of Reference to align with the government policies and to remain relevant in the energy market.

Signed:



**Don Harwin MLC**  
Minister for Energy and Utilities  
Date: