ESSENTIAL SERVICES COMMISSION

Minimum electricity feed-in tariffs to apply from 1 July 2018

Final decision

27 February 2018

An appropriate citation for this paper is:

Essential Services Commission 2018, Minimum electricity feed-in tariffs to apply from 1 July 2018: Final decision 27 February

Copyright notice

Contents

Summary

The commission's final decision is to set two feed-in tariffs (FiTs) to apply from 1 July 2018, of which retailers must offer at least one:[1]

- the time-varying FiT, and/or
- the single-rate FiT.

The final tariff rates are set out in table S.1 and S.2.

Table S.1 Time-varying minimum feed-in tariff – final tariff rates

Tariffs	Minimum rates to apply (c/kWh)		
	Off-peak	Shoulder	Peak
Rates	7.1	10.3	29.0

The final tariff rates are distributed as expected, with peak rates higher than shoulder rates, which themselves are higher than the off-peak rates. Peak rates are significantly higher than the shoulder and off-peak rates because wholesale prices during the evening peak in 2018–19 are forecast to be notably higher than during other periods of the day. This tendency is more pronounced in the forecast for 2018–19 than in previous forecasts that have been used to set the FiT.

Table S.2 Single-rate minimum feed-in tariff – final tariff rate

Tariff	Minimum rate to apply (all times) (c/kWh)
Single-rate minimum feed-in tariff:	9.9

The final single-rate FiT of 9.9 cents per kilowatt hour (c/kWh) represents a 1.4c reduction from the 2017–18 FiT. This outcome may appear counterintuitive, given that average wholesale prices between the two forecast periods have increased by around 18 per cent. It is caused by changes in the prices during the daylight hours when solar photovoltaic (PV) units are exporting electricity, relative to prices during the evening peak. Prices during daylight hours are the prices relevant to setting the single-rate FiT.

[1] Pursuant to section 40FBB(1) of the Electricity Industry Act 2000 (Vic).

Forecasts provided by ACIL Allen indicate that, compared to last year, daytime prices are expected to marginally decrease, while prices in the evening are expected to increase significantly. The reasons for this change in price profile include the introduction of around 190 megawatts (MW) of utility scale solar PV in Victoria, and additional utility scale solar in South Australia and New South Wales during the forecast period.[2] Chapter 4 contains further discussion of this trend.

Furthermore, when calculating the single-rate FiT, prices during daylight hours are weighted to account for how much electricity solar PV units typically export at different times of day (the 'solar export profile'). Prices are forecast to be higher at the start and the end of the day, when solar is exporting less. By contrast, in the middle of the day, when prices are forecast to dip, solar is exporting the most. This explains why the single-rate FiT is slightly lower than the rate during the shoulder period of the time-varying FiT, even though both rates are based on prices during broadly the same time of day.

[2] ACIL Allen forecasts that over 600MW of utility scale solar capacity will come online in South Australia and New South Wales during the forecast period.

1. Introduction

Purpose

This document sets out the commission's final decision on the minimum feed-in tariffs (FiTs) to apply from 1 July 2018.

Context

The commission is required under the Electricity Industry Act 2000 (Vic) (the Act) to determine one or more rates that an electricity retailer must pay its customers for the electricity they export to the grid, referred to as the minimum FiT.[3] This is a credit paid to small renewable energy generation facilities which use fuel sources such as wind, solar, hydro or biomass.[4]

In 2016, the commission concluded its inquiry into the true value of distributed generation (energy value). This represented a major body of research examining the introduction of time-varying FiTs, where the rate varies throughout the day (for instance, on the basis of 'peak' and 'off-peak' periods). This variation in the rate is intended to reflect the underlying value of the electricity, which is based on a wholesale electricity market in which prices change every 30 minutes, and which varies considerably across time.[5]

The inquiry explored how the FiT could be restructured to reflect, on a more granular basis, the varying value of electricity throughout the day. The principle underlying this work is the same as that underlying the move towards more cost-reflective pricing models in the energy industry – that more granular price signals provide incentives for more efficient use of resources. In the case of FiTs, this translates to encouraging customers (acting as generators) to export more power into the grid when demand for electricity is higher.

---

[3] See section 40FBB of the Electricity Industry Act 2000 (Vic) (the Act).

[4] An important exception is that a 'small renewable energy generation facility' does not include a generating facility that is under the premium solar feed-in tariff scheme (Electricity Industry Act section 40F(1)). Further, the Governor in Council, by order published in the Government Gazette, can specify a facility, or class of facility, that generates electricity in any way as a small renewable energy generation facility (Electricity Industry Act section 40F(2)).

[5] The wholesale spot price of electricity is determined though an auction, which is conducted every five minutes by the Australian Energy Market Operator (AEMO). Currently, the process is repeated six times each half hour and generators are paid the average of the six marginal prices for the electricity they generate during that half hour. On 28 November 2017, the Australian Energy Market Commission made a determination to change the settlement period from 30 minutes to five minutes. As a result, the half hourly averaging process will not be required from the proposed commencement date of the rule change of 1 July 2021.

Our inquiry examined a range of options for restructuring the FiT on a time-varying basis. A time-varying FiT is one in which the rate paid to eligible small scale generators varies depending on the time of the day. Specifically, each day is divided into predefined time periods, or 'time blocks'. Common ways of structuring a time-varying tariff include defining 'peak', 'off-peak' and/or shoulder periods.[6]

Our work through the inquiry included different ways of defining 'peak' and 'off-peak', the use of seasonal pricing, and also the introduction of 'critical-peak' pricing. The concept of critical-peak pricing refers to high prices that apply in very short periods of peak demand.

To assess the various options, we considered the principles of market reflectiveness, simplicity, and the potential to elicit a behavioural response. In our final report, we set out our preferred structure for such a tariff, which was based on the peak, shoulder and off-peak periods (that were used for the introduction of flexible retail pricing in Victoria). These were coupled with a critical-peak price to apply during price spikes in the wholesale market.[7] Critical-peak periods were defined as any wholesale market interval when prices exceeded $300 per megawatt hour (MWh). We considered this structure to strike a good balance between the principles outlined above.

The Act has since been amended to allow the commission to set time-varying FiTs.

Structure of this document

After this introduction, our final decision has three sections:

- Section 2 sets out the feedback received on the draft decision and our response
- Section 3 sets out the minimum FiTs to apply from 1 July 2018
- Section 4 describes the methodology used to calculate the minimum FiT.

[6] The concept of a time-varying FiT is also sometimes referred to as a 'time of use FiT', a 'time of export FiT', or a 'multi-rate FiT'.

[7] Essential Services Commission, 'The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report', August 2016, p.53.

2. Stakeholder feedback on our draft decision

Submissions on the draft decision

The draft decision on the minimum electricity feed-in tariffs (FiT) to apply from 1 July 2018 was released for consultation on 19 December 2017. Table 2.1 summarises the key milestones for the consultation process.

Table 2.1 Key consultation milestones

Time	Consultation step
8 November 2017	Stakeholder workshop
19 December 2017	Release of draft decision for consultation
19 December 2017	Stakeholder briefing regarding draft decision
29 January 2018	Submission period closed
28 February 2018	Release of final decision

In total, 213 submissions were received in response to the draft decision (197 from individuals and 16 from organisations).[8] Stakeholders broadly supported the move towards time-varying FiTs, and our proposal to institute a transitional period. Specific feedback fell into the following categories:

- comments relating to policy matters, which are beyond the scope of this process
- the introduction of a time-varying FiT, including regarding the structure of the tariff
- the method of calculating the FiT rates.

This chapter describes stakeholder feedback and sets out our responses.

Policy matters

Legislative framework for setting the minimum feed-in tariff

In response to the draft decision, a number of stakeholders made comments relating to matters associated with the legislative framework within which the commission sets the FiT. For instance,

[8] The complete list of submissions can be found in Appendix E.

several retailers stated their view that the FiT should be deregulated,[9] while the Consumer Action Law Centre suggested the government could consider funding the FiT as a budgetary measure.[10] These views are outside the scope of the annual FiT setting process.

Submissions from three council greenhouse alliances,[11] along with a large number of submissions from individuals, suggested that the single-rate FiT should remain the same, or be increased. Part of the rationale for this argument was the desire to maintain a stable investment environment for solar system purchasers. Alternatively, the view was put that prices should be set on the basis of encouraging more solar systems to be installed. In the words of one customer:

> Small scale solar panels on individual homes need to be encouraged. To further encourage home solar installation, the single rate FIT must not decrease as described in the draft decision, instead it should increase. I believe most solar panel owners monitor their electricity use carefully, and we should be paid a reasonable FIT to provide some return on our costs.[12]

The legislative framework for setting the FiT sets out the matters to which the commission must have regard. Primary among these matters is the wholesale value of the exported electricity, which fluctuates from year to year. Consequently, FiT rates will vary between years. It is not open to the commission to set the rate on the basis of other considerations, such as investment certainty or the objective of promoting more rooftop solar generation.

Social cost of carbon

Feedback on the social cost of carbon fell into two main categories: the cost calculation and the potential for the social cost of carbon value to be applied to grid-sourced electricity via energy storage devices.

---

[9] AGL, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Red Energy and Lumo Energy, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

[10] Consumer Action Law Centre, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

[11] The Eastern Alliance for Greenhouse Action, Northern Alliance for Greenhouse Action and Western Alliance for Greenhouse Action.

[12] Bagwell G, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 1.

For instance, EnergyAustralia sought a review of the social cost of carbon calculation.[13] However, the legislative framework requires us to consider the calculation as it appears in the Order in Council (see discussion in chapter 4).

Other stakeholders, such as St Vincent de Paul Society and Powershop, raised concerns about the FiT potentially being applied to grid electricity. This is a scenario where grid electricity is used to charge a battery before being discharged and exported.[14] Several stakeholders highlighted that this electricity is unlikely to have been generated by renewable sources and is unlikely to displace fossil fuel generation. The Alternative Technology Association questioned the appropriateness of these type of exports being rewarded for avoided social costs of carbon:

> This practice may well benefit the grid overall – buying surplus energy at times of low demand and selling extra at times of high demand helps to balance supply and demand – but the value of avoided carbon being paid for energy that emitted carbon during generation would be a perverse outcome.[15]

We consider these concerns to be more relevant to future FiT setting processes than the current one. The scenario depicted above is unlikely to emerge to any material degree due to the low penetration of batteries. We recognise the issue raised by stakeholders and will continue to work with the relevant government agencies on the appropriate FiT arrangements.

---

[13] EnergyAustralia, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 1-2.

[14] St Vincent de Paul Society, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Powershop, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Consumer Action Law Centre, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Victorian Council of Social Service, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Alternative Technology Association, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

[15] Alternative Technology Association, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 7.

Time-varying feed-in tariff

Transition to the new type of feed-in tariff

Stakeholders broadly supported the introduction of a time-varying FiT, noting its ability to alleviate pressures on the grid, reduce the wholesale cost of electricity during peak periods, and reward small-scale generators for modifying their behaviour (such as changing their patterns of energy demand or time of exports). Additionally, AusNet Services saw the new tariff as one of the means to alleviate network constraints:

> AusNet Services supports the draft decisions to apply time-varying minimum feed in tariff, in addition to a single rate minimum feed-in tariff…. All customers installing additional solar capacity can benefit from the more continuous supply of embedded generation with less voltage constraints on the network.[16]

On the other hand, two retailers and a small number of individual respondents were opposed to the move to time-varying FiTs, suggesting it would be complex and confusing for customers, and if it becomes mandatory, would impose costs on retailers.[17] Other retailers suggested that the option of retailers offering both flat and time-varying tariff structures was preferable and should remain the approach taken by the commission in future years:

> EnergyAustralia is supportive of this approach being adopted permanently as providing two alternative tariff structures provides greater choice for customers and increases market competition between retailers.[18]

While we note that a small number of submitters had concerns about our proposal, we continue to consider that our proposal for the time-varying FiT is appropriate for the coming year. We also note retailer views about extending the transitional period beyond one year, and will reconsider this in the lead-up to the next FiT decision.

---

[16] AusNet Services, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 1.

[17] For example, see AGL, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 1.

[18] EnergyAustralia, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 2.

Feedback on methodology and rates

Rate structure

Feedback on rate structure fell into two categories: feedback relating to critical-peak pricing (which we proposed not to include for 2018–19), and feedback on the suitability of the proposed rate structure in the context of changing wholesale market price patterns.

Several retailers expressed their view that critical-peak pricing was unnecessarily complex and costly, and should not be considered in future years. By contrast, the Clean Energy Council quoted analysis from the Productivity Commission that estimated peak demand events accounting for approximately 25 per cent of electricity bills in NSW, despite occurring less than 1 per cent of the time.[19] The Clean Energy Council also stated:

> To be most effective, cost-reflective feed in tariffs would incorporate a critical peak payment… we understand the complexity of implementing this and the reasons why the government would want to take a measured approach to implementation of cost reflective tariffs. We accept the decision not to implement this approach in 2018 however we would encourage the government to continue to consider critical peak payments for feed-in tariffs as an option for the future.[20]

As stated in our draft decision, we will reconsider the incorporation of critical-peak pricing in next year's FiT decision.

Red Energy and Lumo Energy queried whether our proposed rate structure – based on the peak, shoulder and off-peak periods established for the introduction of flexible retail pricing in Victoria – would remain the appropriate basis for a time-varying FiT in the context of changing wholesale price patterns. Red Energy and Lumo Energy noted that the issue at stake was whether the rate structure would ensure that distributed generation owners were neither over-nor under-compensated for the energy they exported to the grid.

We acknowledged in our draft decision that the wholesale price patterns forecast for 2018–19 represent a change from the patterns of previous years. For the purposes of this decision, we do not consider it necessary to revisit the analysis we undertook on rate structure as part of our

[19] Clean Energy Council, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', February 2018, p. 2.

[20] Clean Energy Council, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', February 2018, p. 2.

distributed generation inquiry in 2019,[21] particularly given that this decision applies to a transition year. However, we recognise the market is evolving, and we intend to consider the rate structure when undertaking our next review of the FiT, for 2019–20.

Calculation of the rates

Stakeholders questioned the forecasted base rates of the FiT for varying reasons. Stakeholders commented that if the forecasted base rates of the FiT were higher than the wholesale prices paid by retailers, retailers would pass their losses on to their customers, as summarised by Victorian Council of Social Services:

> The proposed 'wholesale' peak rate of 29.0 c/kWh under the time-varying tariffs approximates or exceeds some retail peak rates applicable from January 2018. We therefore fear some retailers may increase retail pricing in order to recover costs.[22]

Retailers such as Origin Energy, Red and Lumo Energy and Globird Energy compared the forecasted base rates of the FiT with wholesale prices over the last 12 months and noted a difference in prices compared to the peak rate used in the time-varying FiT. [23]

We have applied a wholesale market modelling approach in setting the base rates of the FiT since 2013 and in our inquiry into the energy value of distributed generation.[24] The commission has opted not to apply historical wholesale prices for setting base rates of the FiT, as they would not necessarily reflect the wholesale market in 2018–19, particularly given the committed large-scale generation that will enter the market.

The Alternative Technology Association also reviewed historical solar PV installation data and found that solar PV installations have recently increased in size. The Alternative Technology

---

[21] Essential Services Commission, 'The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report', August 2016.

[22] Victorian Council of Social Service, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 2.

[23] GloBird, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Origin Energy, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Red Energy and Lumo Energy, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

[24] Essential Services Commission, The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report, August 2016.

Association recommended that the export profiles used to calculate the single flat rate FiT should be updated with more recent data.[25] We currently use export profiles based on solar PV data from 2016 and consider this appropriate in the setting of the FiT in 2018-19. However, we will consider updating this assumption when setting the FiT for 2019–20.

Some stakeholders also commented on some of the assumptions made about wholesale electricity price forecasts. Globird Energy, for instance, questioned whether the estimates on large-scale renewable energy projects should have been based on projects that have been announced rather than those that have been 'committed'.[26]

Market modelling is based on several assumptions about the supply and demand of the wholesale market in a future year. Due to many changes to the wholesale market, particularly with new large-scale generation in Victoria, forecasting has become more challenging. However, the modelling of the proposed FiT base rates was based on ACIL Allen's *PowerMark* model that draws on the best-available reliable information at the time of modelling, and we have not modified these assumptions in our final decision.

In questioning the calculation of the forecasted base rates, a number of stakeholders called for the commission to consider reviewing its approach to modelling wholesale prices for the FiT. Simply Energy recommended that the commission factor in the costs incurred by retailers in managing exposure to volatility in the setting of the FiT:

> Determining the market value of energy which includes either a cap or market reflective price that includes factors like retailers managing their exposure to market volatility, when determining the value for energy.[27]

Given the changing nature of the wholesale market, we will consider refining our forecasting approach in setting the FiT in future years.

---

[25] Alternative Technology Association, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 4.

[26] GloBird Energy, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 2.

[27] Simply Energy, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018, p. 1.

3. Final decision

Transition to time-varying rates

Our final decision is to commence transitioning to time-varying feed-in tariffs (FiTs) in Victoria by setting two FiTs for the period starting 1 July 2018:

- a new time-varying FiT, with peak, shoulder and off-peak rates, using the methodology developed and consulted on through our inquiry into the true value of distributed generation, and
- a single flat-rate FiT using the same methodology developed and consulted on in previous years.

Our final decision is to allow retailers to select which FiT they offer, including whether they offer customers a choice of the two options in 2018–19.

For this transition year, we will not be including a critical-peak rate within the time-varying FiT structure.

During our earlier inquiry, and in consultation with industry since that time, retailers have submitted that the addition of a critical-peak price makes the implementation of a time-varying tariff significantly more difficult. This is because – unlike for the peak, shoulder and off-peak rates – retailers will not know in advance when the critical-peak price will apply. It will be necessary for retailers to identify retrospectively when the wholesale market had exceeded the $300/MWh threshold, and then 'true up' the customers' account to reflect the rate which should have applied during that time interval.

In recognition of this added complexity, we will not be including critical-peak pricing within the time-varying price structure for this transition year on the basis that including it may decrease the likelihood that retailers will offer the time-varying tariff to their customers in 2018–19.

This deferral will also allow us more time to better understand any potential impact of the changing profile of forecast wholesale prices on retailer contracting behaviour, which is relevant to the choice of the $300/MWh threshold for the critical-peak price.

We will review the inclusion of a critical-peak price in the lead up to the next FiT decision, applying to 2019–20.

Rates to apply from 1 July 2018

The tariff structures and rates are set out as follows:

Table 3.1 Time-varying minimum feed-in tariff – final rates

Tariffs	Minimum rates to apply (c/kWh)		
	Off-peak	Shoulder	Peak
Rates	7.1	10.3	29.0

Peak rates are significantly higher than the shoulder and off-peak rates because wholesale prices during the evening peak in 2018–19 are forecast to be higher than during other periods of the day. This tendency is more pronounced in the forecast for 2018-19 than in previous forecasts that have been used to set the FiT.

The time periods – or 'time blocks structure' – for the time-varying FiT are set out in Table 3.2.

Table 3.2 Time block structure for time-varying minimum feed-in tariff

Period	Weekday	Weekend
Off-peak	10pm-7am	10pm-7am
Shoulder	7am-3pm, 9pm-10pm	7am-10pm
Peak	3pm-9pm	n/a

Table 3.3 Single-rate minimum feed-in tariff – final rate

Tariff	Minimum rate to apply (all times) (c/kWh)
Single-rate minimum feed-in tariff:	9.9

The final single-rate FiT of 9.9 c/kWh represents a 1.4c reduction from the FiT that applied in 2017–18. This outcome may appear counterintuitive, given that average wholesale prices between the two forecast periods have increased by around 18 per cent. However, it is caused by changes in the prices during the daylight hours that solar photovoltaic (PV) units are exporting electricity, relative to prices during the evening peak. Prices during daylight hours are the prices relevant to setting the single-rate FiT.

Forecasts provided by ACIL Allen indicate that, compared to the previous year, daytime wholesale prices are expected to marginally decrease, while wholesale prices in the evening are expected to increase significantly. The reasons for this change in price profile (including around 190MW of utility scale solar PV forecasted to come online) are discussed in chapter 4.

Furthermore, when calculating the single-rate FiT, prices during daylight hours are weighted to account for how much electricity solar PV units typically export at different times of day (the 'solar

export profile'). Prices are forecast to be higher at the start and the end of the day, when solar is exporting less. By contrast, in the middle of the day, when prices are forecast to dip, solar is exporting the most. This explains why the single-rate FiT is slightly lower than the rate during the shoulder period of the time-varying FiT, even though both rates are based on prices during broadly the same time of day. Under both the single-rate and the time-varying options, the FiT operates as a minimum rate. That is, for each kilowatt hour (kWh) of electricity exported by a small renewable energy generator, retailers must pay at least the minimum FiT rate, but they may offer more.

For retailers who offer the single-rate FiT, this means they must pay at least 9.9c/kWh for all exports, regardless of what time of day they occur. Retailers who offer the time-varying FiT must, at a minimum, pay the rate that applies at that particular time of day. For instance, for electricity exported at 4pm on a weekday, the retailer must pay at least 29.0c/kWh, but for exports at midday on a weekend it would only be required to pay a minimum of 10.3c/kWh. Moreover, so long as the minimum is met or exceeded in each time period, retailers may structure their FiTs in any way they deem appropriate.

Benefits of setting two FiTs as a transitional measure

A time-varying FiT provides a more granular reflection of how the value of wholesale electricity varies throughout the day than is possible with a single, flat-rate tariff. This provides the opportunity for solar owners to modify their export profile in response to higher and lower prices, if they so choose. Solar owners who modify their behaviour to take advantage of the higher rates during peak periods may be able to capture higher revenues.

However, we recognise that implementation of a time-varying FiT involves various challenges, including for retailers. Consequently, our final decision is to use the 2018–19 period to commence a transition to time-varying rates by allowing retailers to choose which FiT they offer.

Allowing retailers the choice between two FiTs for 2018–19 will have the following benefits:

1. **Retailer systems** - A transition to a mandatory, time-varying FiT will provide retailers with time to update their billing systems.
2. **Competition -** Allowing retailers to choose between tariffs will give them the opportunity to differentiate their service offerings, [28] promoting competition in the retail market. This will benefit consumers as they can choose the retailer whose offering best fits their needs, while still ensuring they receive a regulated minimum regardless of which tariff structure they are on.

[28] That is, the choice between offering the time-varying FiT and the single-rate FiT.

3. **Metering technology -** Some solar customers may still be using analogue (i.e. not smart) metering systems or manually read interval meters (MRIM). These customers may not be able to easily adopt time-varying FiTs without installing additional equipment because their metering technology cannot be read remotely (and analogue meters do not measure and record the time that electricity is exported).
4. **Technical impacts -** A transition period allows more time to consider any impacts a time-varying FiT may have on the network. For instance, the impacts of large numbers of customers exporting simultaneously to take advantage of higher peak prices.

Commencement

Retailers must offer at least one of the tariffs – that is, the time-varying tariff set out in Table 3.1, or the single-rate tariff set out in Table 3.3 – from 1 July 2018.

4. Method

Introduction

This chapter sets out the method used for calculating the feed-in tariff (FiT). It provides a high-level summary of the methodology used for setting both single-rate and time-varying FiTs, and explains the process for determining the wholesale market projections. For a further discussion, see our final report of the energy value stage of our inquiry into the true value of distributed generation.[29]

The chapter also addresses the social cost of carbon, and avoided human health costs. The final section contains a break-down of the components of both the single-rate and time-varying tariffs.

The legal context to this method is outlined in Appendix A.

Method summary

The broad principle underlying the minimum FiT is that the rate, or rates, should be equal to costs avoided by the retailer when they purchase electricity from a small scale generator instead of via the wholesale electricity market. This includes the costs of the electricity that the retailer would otherwise need to purchase from the wholesale market, adjusted for line losses,[30] and any ancillary charges or market fees the retailer would otherwise incur.

Following legislative amendments in February 2017, the method has also included consideration of the avoided social cost of carbon, and the avoided human health costs associated with conventional fossil fuel electricity generation.

With the exception of the calculation of the wholesale component of the FiT, all elements of the method are identical for both the single-rate tariff and the time-varying tariff.

The steps we use to determine the FiT are therefore:

1. Develop a projection of wholesale electricity prices for the relevant year (2018–19).

[29] Essential Services Commission, 'The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report', August 2016.

[30] Line losses refer to the electricity that is lost during transportation from central generators, such as the coal-fired power stations located in the Latrobe Valley. Because some energy is lost in transportation, retailers must purchase more electricity from the wholesale market than is ultimately consumed by the customer. When they instead purchase electricity from a small scale generator, such as a rooftop solar photovoltaic (PV) system, the electricity typically is not transported long distances before it is consumed, meaning the losses are avoided. The wholesale value of small scale generation electricity is therefore 'adjusted for line losses' to account for the fact the retailer avoids purchasing from the wholesale market both the customer's electricity and the additional amount that would have otherwise been lost transporting it from a central generator to the customer.

2. *For the single-rate tariff* – using the projected wholesale prices, calculate the value of wholesale electricity during the hours solar photovoltaic (PV) systems typically export to the grid.[31]
3. *For the time-varying tariff* – using the projected wholesale prices, calculate the value of wholesale electricity during each of the time blocks that form the tariff structure.
4. Adjust the wholesale values to account for line losses.
5. Incorporate market fees and ancillary services charges that are avoided by retailers when they purchase from small scale generators, as opposed to the wholesale market.
6. Incorporate any value associated with the avoided social cost of carbon and the avoided human health costs.

A breakdown of the FiTs that illustrates the value of each of these components is provided in Table 4.3 and Table 4.4. More information, including technical detail and mathematical formulae, can be found in Appendix B

Wholesale market projections

We commissioned ACIL Allen Consulting to forecast prices on the wholesale electricity market for 2018–19.

Using their proprietary wholesale market model, *PowerMark*, ACIL Allen estimates that the unweighted average wholesale market spot price for 2018–19 will be $91.2/MWh.[32]

Calculation of base rates

Base rate for single-rate tariff

While the forecast average wholesale price of electricity for 2018–19 is $91.2/MWh, this does not mean that wholesale electricity is projected to cost exactly that amount at all times. The price of electricity varies with supply and demand. Wholesale prices will typically be low at those times when the amount of energy offered into the wholesale market is high relative to the amount consumers require (and vice versa).

Most of the small scale renewable generation in Victoria is rooftop solar photovoltaic (PV). These systems typically export electricity into the grid during the day, whenever the amount of electricity generated by the solar PV system exceeds the household's demand. In order to accurately reflect the value of wholesale electricity produced by these systems, and because the wholesale value of

[31] Sometimes referred to as a 'solar-weighted' or 'time-weighted' wholesale value.

[32] ACIL Allen's report has been published on the ESC website.

electricity varies across the day, the single-rate FiT is weighted to account for the timing of these exports. This process is known as solar weighting, and it ensures that the value of electricity during periods in which solar PV is *not* exporting electricity – such as in the middle of the night – is not included when establishing the rate the customer receives.

To develop the solar weighting, we calculated average profiles for solar PV exports based on sample data provided to the commission by Victoria's network businesses in 2016.[33] The export data is from a sample of Victorian electricity customers taken from approximately three years leading up to early 2016.

After applying solar weighting, the base rate for the single-rate FiT for 2018–19 is $68.4/Megawatt hour (MWh).

As noted above, the application of solar weighting for 2018–19 produced an unexpected result when compared to the trend in previous years. The solar-weighted average wholesale price is lower than the unweighted average wholesale price. Furthermore, the solar-weighted average wholesale price has dropped between years – the rate for 2018–19 is lower than the solar-weighted wholesale price for 2017–18. In practical terms, this means that the single-rate FiT for 2018–19 is lower than in the previous year, even though wholesale prices have, on average, been trending upwards over this period.

This initially counterintuitive result is explained by the changing profile of wholesale prices across the day. Specifically, ACIL Allen's forecasts indicate that prices during the middle of the day, when solar is exporting, are expected to marginally decrease in 2018–19 relative to prices in that period in the previous year. Part of the explanation for this is the anticipated commissioning of several utility scale solar PV projects during 2018–19 (around 190MW) which will increase the supply of electricity during the hours that solar systems export to the grid, thus dampening prices.[34] Complementing this trend is the ongoing installation of rooftop solar PV, which adds additional supply during solar export periods.

Meanwhile, prices during the evening peak are forecast to increase, which is partly a result of the ongoing rebalancing between baseload and renewable sources of electricity. As a result, more expensive generators (such as gas peaking plants) are expected to be required to meet evening peak demand, meaning that prices during these periods are forecast to be significantly higher. This

[33] During the commission's True Value of Distributed Generation Inquiry.

[34] One utility scale solar project is listed by AEMO as 'committed' during this period – Gannawarra (50MW) – while ACIL Allen advises that another two are also expected to come online during the period – Numurka (38MW), Bannerton (100MW).

is a major factor explaining the increase in the overall average wholesale price for 2018–19. Additional discussion on the changing price profile is contained in Appendix D.

Base rates for time-varying tariffs

In previous years we have applied a flat-rate FiT for all times of the day and year. This year, we are also applying a time-varying FiT containing peak, shoulder and off-peak periods. Consistent with the findings of our inquiry into the true value of distributed generation, these time blocks are identical to those used for the introduction of flexible pricing in Victoria. The time periods – or 'time blocks structure' – for the time-varying rates are set out in Table 4.1.

Table 4.1 Time block structure for time-varying feed-in tariff

Period	Weekday	Weekend
Off-peak	10pm-7am	10pm-7am
Shoulder	7am-3pm, 9pm-10pm	7am-10pm
Peak	3pm-9pm	n/a

Using the wholesale market projections described above, we identified the mean price in each of the time blocks to generate the base rates, which are set out in Table 4.2.

Table 4.2 Base rates for time-varying feed-in tariff

Tariffs	Base rates (unadjusted wholesale value) (c/kWh)		
	Off-peak	Shoulder	Peak
Base rates	4.2	7.2	24.7

Source: ACIL Allen Consulting

The final FiT rates are distributed as expected, with peak rates higher than shoulder rates, which themselves are higher than the off-peak rates. Peak rates are significantly higher than the shoulder and off-peak rates because wholesale prices during the evening peak in 2018–19 are forecast to be higher than during other periods of the day. This tendency is more pronounced in the forecast for 2018–19 than in previous forecasts that have been used to set the FiT.

Line losses, ancillary services and market charges

Market charges and ancillary services

When retailers buy energy from the wholesale market, they must pay market fees and ancillary service charges to the Australian Energy Market Operator (AEMO). They pay these fees based on

the amount of electricity they purchase from the wholesale market, and avoid them to the extent that they source electricity from small renewable generators. We have included these fees when calculating avoided wholesale costs.[35]

The market fees levied by AEMO are set in advance, through its budgeting process. AEMO has estimated its 2018–19 market fees to be $0.51 per MWh or 0.051c/kWh.[36]

For the purpose of determining a FiT that applies from 1 July 2018, we have assumed that the average cost of ancillary services in 2018–19 will be consistent with the average for the period from 2012 to the present. Adding this cost to the market fees described above, the value of ancillary services charges and market fees avoided when a retailer obtains electricity from a small scale renewable generator is 0.72 $/MWh. In keeping with previous years, when rendered in cents per kilowatt hour we have rounded this amount to the nearest 0.1 cent, meaning the value applied for market fees and ancillary services in the FiTs for 2018–19 is 0.1 c/kWh.

Line losses

Typically, energy purchased on the wholesale market is supplied by large central generators located some distance away from the point where the energy is used. Electricity is transported to households and other users via the transmission and distribution network (also known as the grid). During that transportation process, some portion of the energy originally generated is lost as heat. This is known as ‘line losses’.

Small-scale renewable generation reduces line losses since electricity does not need to travel as far from the point where it is generated to the point it is consumed. The extent of this saving varies depends on where the generation is located (and other factors). We have incorporated these cost savings into the FiTs by applying a ‘loss factor’ as part of the avoided cost of purchasing energy on the wholesale market.

Using loss factors for Victoria as published by AEMO, we have estimated a loss factor of 1.0675. We apply the loss factor to the forecast solar-weighted average pool price, including market fees and ancillary charges, of 6.9c/kWh to produce the loss adjusted amount of 7.4c/kWh, an increase of 0.5c/kWh. The effect of the loss adjustment on the each of the rates within time-varying tariff is set out in Table 4.3.

[35] Pursuant to section 40FBB(3) of the Act.

[36] Australian Energy Market Operator, ‘Consolidated Final Budget and Fees 2017-18’, May 2017.

Social cost of carbon and avoided human health costs

Energy sold on the wholesale market is generated using a variety of fuel sources and technologies. These include coal, gas, wind farms and hydroelectric power. In Victoria, most wholesale electricity is generated by coal-fired power stations, which produce carbon emissions. These emissions are reduced when energy is sourced from small scale renewable generators.

During our inquiry into the true value of distributed generation, we examined the benefit of reduced carbon dioxide emissions and found that, while it was possible to estimate the quantum of this benefit, it was not possible for us to determine a value for it. We arrived at this conclusion on the basis that in the absence of a market, the value of greenhouse gas reductions is a matter for policymakers.[37]

We also examined the potential health benefits associated with a reduction of fossil fuel generation caused by the uptake of small renewable distributed generation systems, such as solar PV. We found that it was possible to link the generation of electricity from these distributed generation systems with a reduction of fossil fuel generation, and therefore a reduction in the negative health effects associated with the latter. For example, this could include avoided respiratory-related health impacts from air pollution caused by coal-fired power stations. However, we also found the causal chain was too lengthy and uncertain to reliably attribute a given quantum of health benefit with a given unit of output from distributed generation. As a result, we did not add a monetary value for health benefit to the FiT.[38]

In February 2017, the Government issued an Order in Council specifying a method for determining the social cost of carbon.[39] Applying that method yields a value of 2.5 cents per kilowatt hour of electricity exported by a small renewable generator, which we add to both the single-rate and time-varying tariffs.

The order did not specify a factor or method for determining avoided human health costs.

Feed-in tariff break-down

A summary of the minimum FiT is provided in Tables 4.3 and Table 4.4 below.

---

[37] Essential Services Commission, 'The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report', August 2016, 87-8.

[38] Essential Services Commission, 'The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report', August 2016, 67-8.

[39] Victorian Government 2017, Victoria Government Gazette No. S 36, Tuesday 21 February 2017, Order specifying a methodology and factors for the determination of the avoided social cost of carbon (Order in Council)

Table 4.3 Time-varying feed-in tariff breakdown – final rates[40]

Tariff component	Value (c/kWh)		
	Off-peak	Shoulder	Peak
Forecast average wholesale electricity pool price (base rate)	4.2	7.2	24.7
Avoided market fees and ancillary service charges	0.1	0.1	0.1
Sub total	*4.3*	*7.3*	*24.8*
Loss adjustment (multiply)	1.0675	1.0675	1.0675
Value of avoided distribution and transmission losses	0.3	0.5	1.7
Sub total	*4.6*	*7.8*	*26.5*
Value of avoided social cost of carbon	2.5	2.5	2.5
TOTALS	**7.1**	**10.3**	**29.0**

Table 4.4 Single-rate feed-in tariff breakdown – final rates

Tariff component	Value (c/kWh)
Forecast solar-weighted wholesale electricity pool price (base rate)	6.8
Avoided market fees and ancillary service charges	0.1
Sub total	*6.9*
Loss adjustment (multiply)	1.0675
Value of avoided distribution and transmission losses	0.5
Sub total	*7.4*
Value of avoided social cost of carbon	2.5
TOTAL	**9.9**

[40] Note, the sub-total off-peak value of 4.4 c/kWh has been corrected from the Draft Decision to 4.3 c/kWh in this Final Decision.

Abbreviations

Term	Definition
AEMO	Australian Energy Market Operator
c/kWh	cents per kilowatt hour
DLF	Distribution loss factor
FiT	Feed-in tariff
kW	Kilowatts
kWh	Kilowatt hour
MLF	Marginal loss factor
MWh	Megawatt hour
MW	Megawatts

Glossary

Term	Definition
the Act	Electricity Industry Act 2000 (Vic)
commission	Essential Services Commission (Victoria)
Inquiry	Commission's 2016 inquiry into the true value of distributed generation
Small renewable energy generator	A wind, solar, hydro, biomass energy facility (or other facility if specified by Order in Council) connected to a distribution system that generates electricity and has an installed or name-plate generating capacity of less than 100 kilowatts.
Relevant retailer	A person that holds a licence to sell electricity and sells to more than 5,000 customers.

References

ACIL Allen Consulting, 'Victorian Feed-in Tariff: Estimate of energy value', December 2016.

AGL, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Alternative Technology Association, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

AusNet Services, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Australian Energy Market Operator, 'Consolidated Final Budget and Fees 2017-18', May 2017.

Bagwell, G, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Clean Energy Council, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', February 2018.

Consumer Action Law Centre, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Eastern Alliance for Greenhouse Action, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Electricity Industry Act 2000 (Vic)

EnergyAustralia, submission to the Essential Services Commission consultation paper 'Draft decision on the electricity feed-in tariffs to apply from 1 July 2018', January 2018.

Energy Legislation Amendment (Feed-in Tariffs and Improving Safety and Markets) Act 2017 (Vic), assent date 14 February 2017.

Essential Services Commission, 'The Energy Value of Distributed Generation: Distributed Generation Inquiry Stage 1 Final Report', August 2016.

Essential Services Commission, 'Minimum Electricity Feed-in Tariff to Apply from 1 January 2016 to 31 December 2016 – Final Decision', August 2015.

Essential Services Commission, ‘Minimum Electricity Feed-in Tariff to Apply from 1 January 2015 – Final Decision’, August 2014.

Essential Services Commission, ‘Minimum Electricity Feed-in Tariff to Apply from 1 January 2014 to 31 December 2014 – Final Decision’, August 2013.

GloBird Energy, submission to the Essential Services Commission consultation paper ‘Draft decision on the electricity feed-in tariffs to apply from 1 July 2018’, January 2018.

Red Energy and Lumo Energy submission, to the Essential Services Commission consultation paper ‘Draft decision on the electricity feed-in tariffs to apply from 1 July 2018’, January 2018.

Simply Energy, submission to the Essential Services Commission consultation paper ‘Draft decision on the electricity feed-in tariffs to apply from 1 July 2018’, January 2018.

St Vincent de Paul Society, submission to the Essential Services Commission consultation paper ‘Draft decision on the electricity feed-in tariffs to apply from 1 July 2018’, January 2018.

Victorian Council of Social Service, submission to the Essential Services Commission consultation paper ‘Draft decision on the electricity feed-in tariffs to apply from 1 July 2018’, January 2018.

Victorian Government, ‘Victoria Government Gazette No. S 36, Tuesday 21 February 2017, Order specifying a methodology and factors for the determination of the avoided social cost of carbon’, February 2017.

Appendix A – Legal context

The commission is required under the Electricity Industry Act 2000 (Vic) (the Act), to determine one or more rates for the amount that is to be credited to the charges payable to a retailer by a customer who is a relevant generator, for electricity they produce from a small renewable energy generation facility and export to the grid.[41] This rate or rates are referred to as the minimum feed-in tariff (FiT).

The FiT is credited by a relevant retailer[42] to each customer for every kilowatt hour (kWh) of electricity[43] exported to the grid. It applies to small renewable energy generation facilities with capacities of less than 100 kilowatts (kW) that produce electricity using renewable energy sources such as wind, solar, hydro or biomass.[44]

Each year, the commission determines the minimum FiT for the following year.[45] The new FiT described in this document will apply from 1 July 2018.

By law, the commission must take into account certain factors in determining the minimum FiT.[46] These factors include:

1. the prices of electricity in the wholesale electricity market
2. any distribution and transmission losses avoided in Victoria as a result of small renewable energy generation.

The commission must also have regard to the avoided social cost of carbon and avoided human health costs which can be attributed to reduced air pollution caused by small renewable energy

---

[41] See sections 40FB and 40FBB(1), and definition of 'relevant generator' in section 40F of the Electricity Industry Act 2000 (the Act).

[42] A person that holds a licence to sell electricity and sells to more than 5,000 customers.

[43] This is the electricity as defined as 'small renewable energy generation electricity' as defined in section 40F of the Act.

[44] See definitions of 'small renewable energy generation facility' in section 40F of the Act. An important exception is that a 'small renewable energy generation facility' does not include a generating facility that is under the premium solar feed-in tariff scheme (section 40F(1) of the Act). Further, the Governor in Council, by order published in the Government Gazette, can specify a facility or class of facility that generates electricity in any way as a small renewable energy generation facility (section 40F(2) of the Act).

[45] While this has previously been done on a calendar year basis, following recent amendments to the Act the commission is now required to set one or more rates (section 40FBB(2)) by 28 February in the financial year preceding the financial year in which it is to apply (section 40FBB(1). See Energy Legislation Amendment (Feed-in Tariffs and Improving Safety and Markets) Act 2017 (Vic), assent date 14 February 2017.

[46] The factors that the commission must have regard to in determining the FiT that applies from 1 July 2018 are set out in section 40FBB(3) of the Act.

generators.[47] The Actallows the Governor in Council to issue an order specifying a methodology or factors for determining these avoided costs. [48] An order made in 2017 sets out factors and methodologies including the following:

1. methodologies for determining the number of units of carbon dioxide equivalent (CO_2e) reduced per unit of electricity exported from a small renewable energy generator
2. the monetary value for each of unit of CO_2e that is reduced because of the exports of a small renewable energy generator. [49]

The order did not specify factors or methodologies for determining the avoided human health costs caused by a reduction in air pollution

[47] Following recent amendments to section 40FBB(3) of the Act.

[48] Section 40FBB(3B).

[49] Victorian Government 2017, 'Victoria Government Gazette No. S 36', Tuesday 21 February 2017.

Appendix B – Technical methodology

The commission has set two feed-in tariff (FiT) rate options to apply from 1 July 2018. The methodology we have used to determine the FiT options is based on the methodology established in our determination of the 2014, 2015 and 2017 FiTs, with the inclusion of an additional component for calculating a time-varying FiT.

The methodology comprises estimating the following components:

- wholesale value of electricity produced by small scale renewable generators, which is based on the cost of purchasing the same amounts of energy, at the same times, from central generators via the wholesale electricity pool (referred to as the 'avoided energy cost'). This includes:
  - wholesale electricity price forecast
    - with solar weighting to calculate base rates for single-rate FiT
    - the median price within time blocks (peak, shoulder, off-peak times) to calculate base rates for time-varying FiT
  - avoided distribution and transmission losses
  - avoided ancillary service charges and market fees.
- avoided social costs of carbon and avoided human health costs.

Wholesale energy value

The formula for determining the wholesale electricity value that has been used by the commission in past FiT determinations and for the flat-rate FiT in this decision is:

$$Avoided\ energy\ cost = LF \times \sum_{t=1}^{n} w_t p_t \qquad \text{(AB.1)}$$

where:

LF is the loss factor

w_t is the weighting that applies in time interval t

p_t is the wholesale electricity price that applies in time interval t

n is the 17,520 half hourly time intervals in the year.

Wholesale price projections

All wholesale electricity in Victoria is traded through the wholesale National Electricity Market (NEM).

The wholesale spot price of electricity is determined through a series of auctions that are conducted every five minutes, and averaged to the half-hour level. There are 17,520 half-hours in a year so there are 17,520 wholesale electricity spot prices in Victoria every year.

The FiT needs to be set in advance, so it is based on projections of these spot prices that ACIL Allen prepared using its PowerMark proprietary model of the NEM's wholesale spot market.

The projections in this report cover financial year 2018–19. They were prepared in November 2017.

They are based on demand forecasts produced by the AEMO in its 2017 National Electricity Forecasting Report (NEFR) and ACIL Allen's internal supply assumptions. The projections were prepared on the assumption that:

- the aluminium smelter at Portland will continue to operate
- the Large scale Renewable Energy Target (LRET) will continue in its current form with the current target
- the Victorian Renewable Energy Target (VRET) will proceed as planned.

There are various policy uncertainties in the electricity market at the time of writing. These relate to questions such as the form the National Energy Guarantee (NEG) might take and indeed whether it will be implemented. The NEG is not reflected in the modelling discussed here.

Solar weighting

The weighting that is applied in each wholesale price time interval is based on a small scale solar photovoltaic (PV) system export profile. This reflects the fact that the predominant form of small renewable energy generation system in Victoria is rooftop solar PV.

In previous years, the commission calculated average profiles for solar PV exports based on sample data for the actual exports of approximately 1,000 solar PV customers in 2013.[50] When setting the FiT, we have used a sample based on information provided to the commission by

[50] Essential Services Commission, 'Minimum Electricity Feed-in Tariff to Apply from 1 January 2014 to 31 December 2014 – Final Decision', August 2013, pp. 26-29, Essential Services Commission, 'Minimum Electricity Feed-in Tariff to Apply from 1 January 2015 – Final Decision', August 2014, pp. 15-17, Essential Services Commission, 'Minimum Electricity Feed-in Tariff to Apply from 1 January 2016 to 31 December 2016 – Final Decision', August 2015, pp. 11-12.

Victoria's network businesses in 2016.[51] The export data is of a sample of Victorian electricity customers in approximately the three years leading up to early 2016. We continue to use this dataset to inform the solar weighting.

The methodology for forecasting the wholesale prices and the approach to applying solar weighting accounts for and aligns the impact of weather variations.

The forecast solar-weighted average pool price for 2018–19 is $68.4/MWh.

Wholesale prices based on timeblocks

A multi-rate FiT energy value is the value of the projected wholesale spot price at certain times of day adjusted for losses, market fees and ancillary service charges. Unlike the single-rate approach, the multi-rate approach does not rely on weighting so it is not 'tied' to any particular technology.

The time blocks used here are those established by the Victorian Government for the standard flexible pricing tariff.

Avoided ancillary service charges and market fees

Retailers pay market fees and ancillary service charges to AEMO to support its role of managing the wholesale electricity market, and we include these as avoided costs associated with electricity that is exported to the grid. Retailers pay these fees based on the amount of their purchases from the wholesale electricity market and avoid these fees to the extent that they source electricity from small renewable generators. Consideration of these fees is therefore considered a component of the commission's consideration of prices in the electricity wholesale market pursuant to section 40FBB(3) of the Act.

The market fees that are levied by AEMO are set in advance through its budgeting process. AEMO has estimated its 2018–19 market fees to be $0.51 per MWh or 0.051c/kWh.

The cost of ancillary services is recovered from market participants. On a weekly basis, AEMO publishes data showing the cost recovery rate for ancillary services. In 2017 (to mid-November), that recovery rate ranged from $0.10 per MWh to $0.25 per MWh, with an average in the period since 2012 of $0.22 per MWh, or 0.022c/kWh.

For the purpose of determining a FiT that applies from 1 July 2017, we assume that the average cost of ancillary services in 2018–19 will be consistent with the average from 2012 to mid-

[51] During the commission's True Value of Distributed Generation Inquiry.

November 2017. When this is added to the relevant market fees, the value of ancillary services charges and market fees avoided when a retailer obtains electricity from a small-scale renewable generator is 0.72 c/kWh. When incorporated in the FiT rates, this is rounded to a single decimal place.

Avoided distribution and transmission losses

Line losses are taken into account when determining the FiT rates by applying a loss factor to the projected wholesale electricity prices, as shown in formula AB.1.

The wholesale electricity price published by the AEMO is determined at the Regional Reference Node (RRN), and this price includes transmission losses between generators and the RRN.[52]

The loss factor used in formula AB.1 takes into account the cost of line losses that occur between the RRN and the end-customer meters. This has two parts:

- transmission line losses between the RRN and each bulk supply connection point (or terminal station) are measured by marginal loss factors (MLFs) published by AEMO[53]
- distribution line losses are measured by distribution loss factors (DLFs), which are estimated by each distribution network service provider and published by AEMO.[54]

The combined loss factor for a particular locality and voltage class can be calculated as:

$$Loss\ factor = MLF \times DLF \qquad \text{(AB.2)}$$

Formula AB.2 has been quantified as follows.

AEMO estimates the MLF for every transmission network connection point. DLFs are estimated by the distribution network service providers in each zone for each line voltage class and published by AEMO. Using this data, we estimate the weighted average loss factor for Victorian mass-market customers at 1.0675 in 2018–19. We then apply the loss factor of 1.0675 to the forecast solar-weighted average pool price (including ancillary charges and market fees) of 6.9c/kWh to produce the loss adjusted amount of 7.4c/kWh, an increase of 0.5c/kWh.

[52] In Victoria the RRN is at Thomastown.

[53] The MLF measures the amount of additional generation that would be required at the RRN to deliver 1 kW of electricity to the transmission network connection point (or terminal station).

[54] The DLF represents the average quantity of electricity that needs to be transported across a distribution network in order to provide for one unit of consumption at the customer's premises. DLFs are generally greater than one.

Avoided social cost of carbon

An order in Council published on 21 February 2017 specifies the factors and methodologies for determining the avoided social cost of carbon to which the commission must have regard when setting the FiT.[55]

The order specifies that the avoided social cost of carbon is calculated in terms of the avoided social cost of carbon per unit of exported electricity from a small renewable energy generator, and is to be determined in accordance with the following methodology.

$$Avoided\ social\ cost\ of\ carbon = Volume\ factor \times Price\ factor \quad \text{(AB.3)}$$

The order specifies the factors the commission must use when applying this methodology.

With regard to the volume factor, the commission must use an emissions intensity coefficient factor of 1.27 kilograms (kg) of carbon dioxide equivalent (CO_2e) per kWh of electricity exported by a small renewable energy generator. This means that 1.27 kg of CO_2e is assumed to be avoided for each kWh exported by a small renewable energy generator (or 0.00127 tonne of CO_2e avoided per kWh exported).

With regard to the price factor, the order specifies a method for determining the value, which the commission has applied to determine a value per tonne of CO_2e of $19.63.

The resulting avoided social cost of carbon is $0.025 per kWh of electricity exported by a small renewable energy generator.

[55] Victorian Government 2017, Victoria Government Gazette No. S 36, Tuesday 21 February 2017, Order specifying a methodology and factors for the determination of the avoided social cost of carbon (Order in Council).

Appendix C – Comparison to previous years' feed-in tariffs (flat-rate tariffs)

Table AC.1 Comparison of flat-rate feed-in tariffs – 2015 to 2018–19

Feed-in Tariff Component	2015	2016	2017-18[56]	2018-19[a]
	(c/kWh)	(c/kWh)	(c/kWh)	(c/kWh)
Forecast solar-weighted average wholesale electricity pool price	5.7	4.6	8.1	6.8
Avoided market fees and ancillary service charges	0.05	0.1	0.1	0.1
Value of avoided distribution and transmission losses	0.4	0.3	0.6	0.5
Value of avoided social cost of carbon	n/a	n/a	2.5	2.5
FiT Rate	**6.2**	**5.0**	**11.3**	**9.9**

[a] Final rates

[56] Following legislative amendments in February 2017, the feed-in tariff moved on to the financial year basis.

Appendix D – Discussion of wholesale price patterns for 2018–19

As discussed in chapter 4, the application of solar weighting for 2018–19 produced an unexpected result when compared to the trend in previous years. The solar-weighted average wholesale price is lower than the unweighted average wholesale price. Furthermore, the solar-weighted average wholesale price has dropped between years – the rate for 2018–19 is lower than the solar-weighted wholesale price for 2017–18. In practical terms, this means that the single-rate FiT for 2018–19 is lower than in the previous year, even though wholesale prices have, on average, been trending upwards over this period.

This result is explained by the changing profile of wholesale prices across the day. ACIL Allen forecast that prices in the middle of the day will be lower in 2018–19 when compared to 2017–18. Meanwhile, they are forecasting that prices in the evening will be significantly higher, which will drive up the overall average wholesale price. Because the single-rate FiT is calculated based on the value of wholesale electricity at the times that solar PV is exporting to the grid (ie during the day), this price profile explains why the single-rate tariff has decreased despite the fact that average wholesale prices are expected to increase.

To demonstrate the changing price profile, Figure AD.1 sets out the relationship between hourly wholesale prices, the average wholesale price, and the solar-weighted wholesale price. It shows in simple terms how these values have shifted in the forecasts that have underpinned this FiT decision, relative to the previous two FiT decisions (for 2016 and 2017–18).

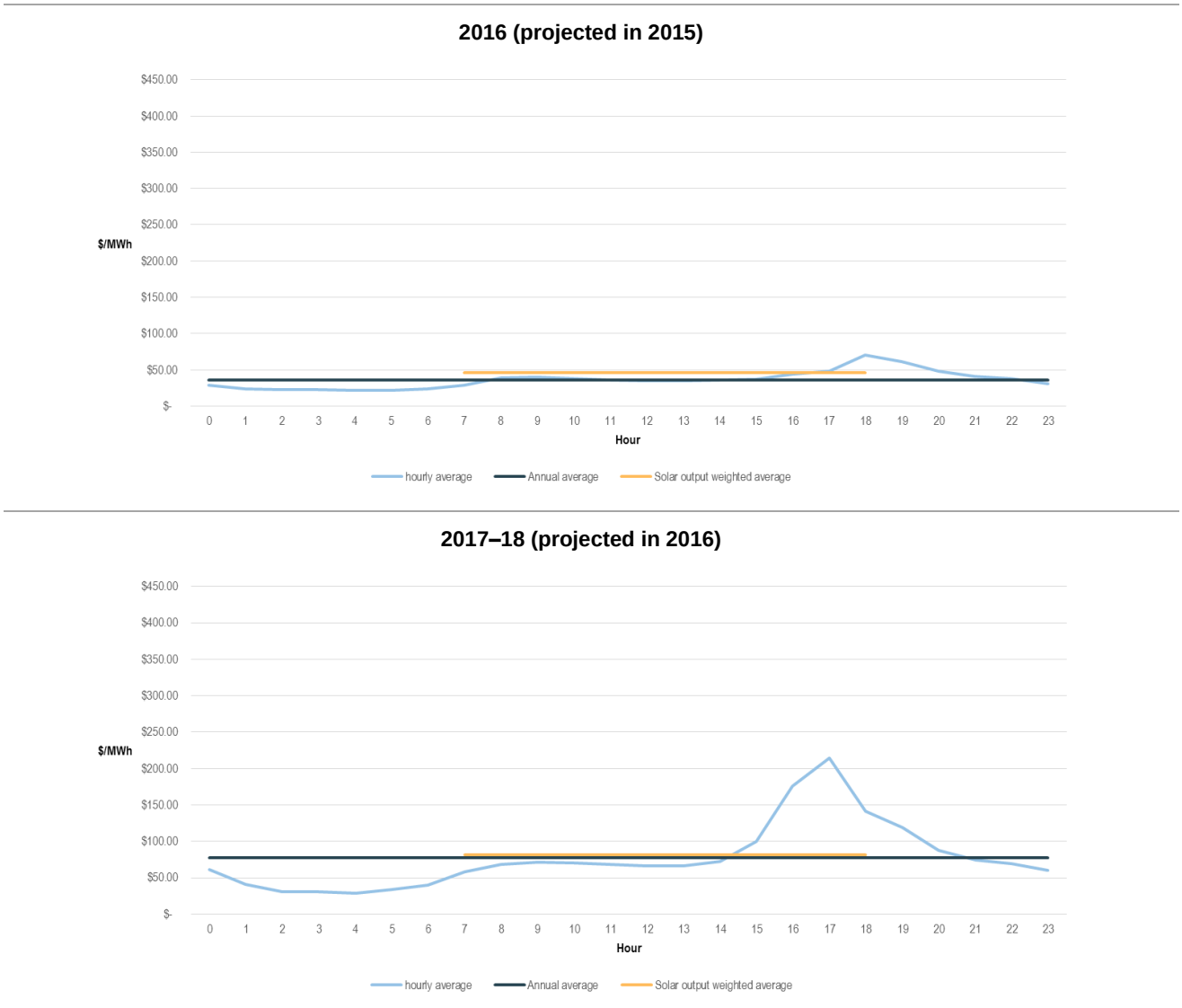
The light blue curve shows the distribution of wholesale prices across the day, while the dark blue curve shows the annual average wholesale price.[57] The orange line shows the export-weighted average wholesale price during the hours that rooftop solar PV systems typically export to the grid – in other words, the solar-weighted average wholesale price.

As the charts show, in the forecasts for 2016 and 2017–18, the solar-weighted average wholesale price (orange line) exceeded the average wholesale price (dark blue line). By contrast, the forecast for 2018–19 shows significant evening peaks (light blue line), which are largely outside the hours that solar PV exports electricity to the grid. Accordingly, these high prices – which are driving average wholesale prices up – do not play a material role in determining the solar-weighted average wholesale price. In other words, they do not contribute materially to the FiT rate.

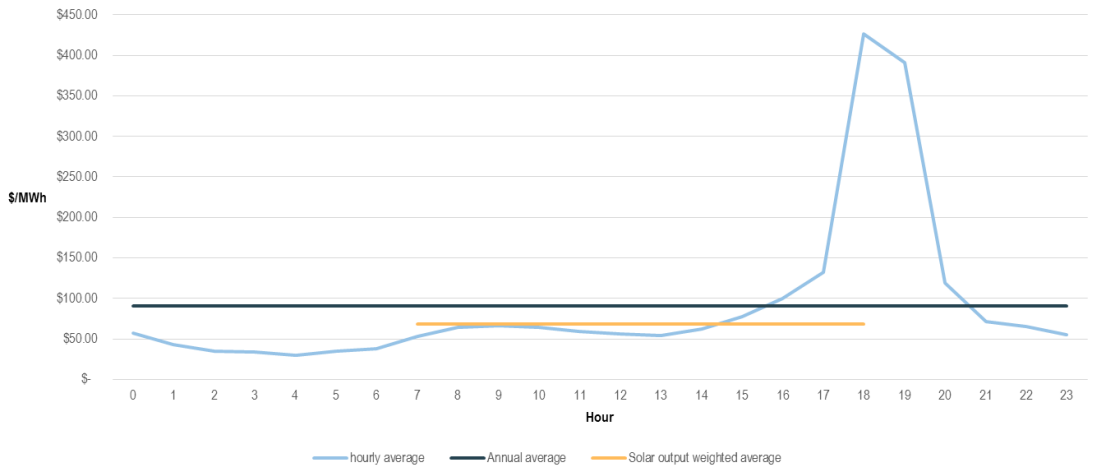
[57] The average annual wholesale price is unweighted (ie not load weighted).

Furthermore, as the third chart indicates, prices during the middle of the day – when solar is exporting the most – are actually trending downwards relative to previous years. Consequently, the forecast solar-weighted average wholesale price for 2018–19 is both lower than the forecast average wholesale price for that year, and lower than the solar-weighted average wholesale price for the previous year's forecast. This relationship in the chart demonstrates why the single-rate FiT has dropped between 2017–18 and 2018–19, despite the fact average wholesale prices have increased.

Figure AD.1 – Time and solar weighed wholesale price forecasts, by hour (2016 to 2018–19)



2018–19 (projected in 2017)



The reasons for this change in wholesale price profile include the fact that a number of large scale utility solar projects are expected to come on line during the forecast period. The solar generators (totalling almost 190 megawatts of nameplate capacity) are:

- Gannawarra (50MW)
- Numurka (38MW)
- Bannerton (100MW)

ACIL Allen also forecast that additional utility scale solar projects will come online in neighbouring jurisdictions which contain interconnected markets. It estimates that around 320MW will be added across New South Wales and South Australia in 2018–19. A further 1,620MW of utility scale solar is projected to be added in Queensland. More information about these projections is contained in ACIL Allen's report, which is available on the commission website.

The addition of this solar capacity is forecast to apply downward pressure to prices during the daylight hours that solar PV will be exporting to the grid. Due to their lack of fuel costs, solar generators have a very low short run marginal cost and therefore bid into the wholesale market at very low prices. Wholesale prices during the periods the solar is generated are expected to decrease accordingly.

Supplementing the additional utility-scale solar is the ongoing high rate of rooftop solar installation, which further increases the supply of electricity during the middle hours of the day. In this way, solar installation trends have been contributing to the gradual shift in wholesale price profile for a number of years, making the eventual inversion of average wholesale price and solar-weighted average wholesale price an inevitability.

Another factor influencing the wholesale price profile is the rebalancing between baseload and renewable sources of electricity. As a result, more expensive generators (such as gas peaking

plans) are required to meet evening peak demand, which in turn means that prices during these periods are forecast to be higher.

5. Appendix E – Submissions to the draft decision

Organisations

Electricity retailers

- AGL
- Energy Australia
- GloBird Energy
- Origin Energy
- Powershop
- Red Energy and Lumo Energy
- Simply Energy

Consumer groups

- Consumer Action Law Centre
- St Vincent de Paul Society
- Victorian Council of Social Service

Council alliances

- Eastern Alliance for Greenhouse Action
- Northern Alliance for Greenhouse Action
- Western Alliance for Greenhouse Action

Clean energy groups

- Alternative Technology Association
- Clean Energy Council

Distributors

- AusNet Services

Individuals

Anonymous
Steven Adams
Tim Adams
Leigh Adamson
Keith Altmann
Kelvin Anderson
Maureen Andrew
Siegfried Angerer
Ian Armstrong
Brenton Arnold
Donald Ash
Bruce Atkin
William Attard
John Bagnati
Geraldine Bagwell
Peter Baillie
Marcus Barber
Carol Barrie
Carol Barrie
Kevin Birchall
Michael Bissett
Wayne Bolton
Richard Bouwmeester
Robert Burdett
Matt Campbell

Carlo Canteri
Kelvin Carnegie
Noelene Carr
Renee Carruthers
James Chan
Bruce Chugg
David Clarke
Kevin Close
Lee Coleman
Terry Collie
Ray Cowling
Geoff Cumming
Robert Davie
Anne Davie
Johan de Bree
Glenn Dernaj
Ian Dickson
Barry Dingle
Lois Doeven
Gabrielle Doolan
Felix Ebeyer
Jenny Edgar
John Elliott
Peter Essex
Maggie Evison

Brett Factor
Mario Farrugia
Sandra Firth-Williamson
Julie Fisher
Nicolas Fontaine
Helen Franks
Peter Galvin
John Gardiner
Chrissy Geddes
Peter Geddes
M. Georgiou
Wickham Gill
Peter Gladwell
David Gnaniah
Hilary Gormley
Michael Gowty
Keith Graham
Barry Grant
Jim Haine
Neil Hallam
John Hardy
Margaret Hartley
Graeme Harvey
Geoff Harvey
Graeme Hattwell

Norm Henry
John Herbert
Wey Ho
Gabriella Hont
Peter Hormann
Maxwell Howe
Neville Hunter
William Hutchinson
Rosemary Jacobs
Wendy James
John Jarrott
Brian Jenkins
Damien Jensen
Chris Judd
Steve Kearney
David Kennedy
Rhonda Keogh
Jeremy Klitzing
Mario Kohler
Nick Konstantinidis
Jorg Koplin
Alan Kruger
Dirk Kurpershoek
Jason Leatham
Joe Lenzo
Seht Leong
Morry Leyland
Peter Lightbody
Andrea Lindsay
Gary Linley
Geoffrey Linnell
Bill Little
Mario Lupieri
Jenny Macgill
Frances Mackieson
Anne Makhijani
Janice Maltby
Paul Mannings
Alison Marchant
Peter Margate
Graham McAnalley
Jack McCaughan
Joan McColl
Kim McConchie
Diane McInerney
Warren McLaren
Rod Milne
Wendy Mullet
Stephen Murphy
Graham Murray
Deniz Mutlu
John Nairn
John Nairn
Dolores Nelly
Irene Noon
Phil Oates
Russel O'Brien
Jill O'Callaghan
Benjamin O'Connor
Robert Olds
Glenn Osboldstone
Liz Pain
James Parsons
Keith Patton
Russell Peel
Sheila Pollard
Joseph Posterino
Robert Potts
Paul Priems
Geoff Randall
Peter Reeves
Peter Rice
Peter Richardson
Malcom Rickarby
Russell Ritchie
John Ross
Linda Rowley
Michael Rush

Chris Ryan

Mario Santos

Robert Schilt

David Skerry

Jenny Smith

Peter Sommers

Agner Sorensen

Wal St Clair

David Steele

George Stevenson

Noel Stone

Jim Szymanski

Wendy Tanner

Greg Tanner

Bruce Taylor

Kevin Thorpe

Shaune Thorpe

Antoinette Tidey

Antoinette Tidey

David Tomkins

Diana Trainor

Laurie Tuddin

Barrie Tyson

David U

Russel Vernon

Bodo von Billerbeck

Michael Wakefield

Gordon Wallace

Graeme Walters

Geoff Ward

Gerry Ward

Rodney Waterman

Paul Webster

Michael Webster

Rob Wellington

Dean Wheeler

Carol Wicks

Sharlene Williams

Thomas Williams

Tim Winter

Buzz Rainbow Wolf

Raymond Woods

Alison Wright

Matthew Wright