ESSENTIAL SERVICES COMMISSION

MINIMUM ELECTRICITY FEED-IN TARIFF TO APPLY FROM 1 JANUARY 2015

Final Decision

August 2014

ACRONYMS & ABBREVIATIONS

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
c/kWh	cents per kilowatt hour
COAG	Council of Australian Governments
Commission	Essential Services Commission Victoria
DLF	Distribution loss factor
EIA	*Electricity Industry Act 2000*
ESC Act	*Essential Services Commission Act 2001*
ESCOSA	Essential Services Commission of South Australia
FiT	Feed-in tariff
IPART	Independent Pricing and Regulatory Tribunal, NSW
kW	kilowatts
kWh	kilowatt hour
MLF	Marginal loss factor
NEM	National electricity market
NSLP	Net system load profile
PC	Productivity Commission
PV	photovoltaic
QCA	Queensland Competition Authority
RRN	Regional Reference Node
VCEC	Victorian Competition and Efficiency Commission

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FINAL DECISION

Pursuant to section 40FBB(1) of the *Electricity Industry Act 2000* (Vic), the Essential Services Commission's ('Commission') final decision is that the rate for purchases of small renewable energy generation electricity, for the purposes of section 40FBA(b)(i) of the same Act, and for the calendar year commencing 1 January 2015, is 6.2 cents per kilowatt-hour ($0.062/kWh).

FINAL DECISION PROCESS

The process by which the Commission reached its final decision was as follows:

A draft decision was released in May 2014 which:

- described the Commission's proposed methodology for setting the minimum feed-in tariff (FiT), and

- indicated the proposed FiT to apply for the calendar year commencing 1 January 2015.

Ten submissions were received in response to the draft decision, from:

- energy retailers: AGL, Lumo Energy and Origin Energy

- the Energy Retailers Association of Australia (ERAA),

- groups with an interest in renewable energy generation: the Alternative Technology Association (ATA) and the Clean Energy Council (CEC), and

- individuals: Ms Angela McLean, Mr Dunstan Girton, Mr John Bolton and Mr Nick Legge.

These submissions can be found on our website (www.esc.vic.gov.au).

The Commission has given consideration to the information and views presented in these submissions, and the issues raised are discussed in the report. Several submissions supported the Commission's proposed approach and none have introduced information or raised issues that have led the Commission to change its approach or the analysis put forward in the draft decision.

In the draft decision, the minimum FiT was calculated with and without the carbon price. It was proposed that a minimum FiT inclusive of the carbon price would apply until the carbon price was removed, after which it would revert to a value calculated excluding the carbon price. On 17 July 2014, the Commonwealth Parliament passed the *Clean Energy Legislation (Carbon Tax Repeal) Act 2014,* and the minimum FiT is now solely calculated excluding the carbon price.

FINAL DECISION SUMMARY

In determining the fair and efficient value of small scale embedded generation exports, the Commission has used the 'wholesale price plus' approach recommended by the Victorian Competition and Efficiency Commission (VCEC) and adopted by other jurisdictional regulators. The wholesale electricity spot market price corresponds to the marginal energy purchase cost that is avoided by an electricity retailer when one of its embedded generating customers exports an additional unit of electricity into the grid. For this reason, the wholesale spot price is the relevant avoided energy cost in relation to the marginal unit of embedded generation.

The 'plus' element of the 'wholesale price plus' formula refers to other identifiable avoided costs associated with embedded generation. Because embedded generation reduces the average distance between generation and consumption, it is believed to reduce overall line losses. Thus, consistent with the approach adopted in other jurisdictions, the Commission has accepted that line losses are avoided because of embedded generation.

Two changes have been made to the formula used by the Commission for the 2014 FiT. Previously the Commission only included the effect of distribution line losses; from 2015 we have also included certain transmission line losses. These distribution and transmission loss factors are as published by the Australian Energy Market Operator (AEMO). The combined weighted average loss factor for the five distribution zones in Victoria is calculated as 1.07. The Commission has also included avoided market operator fees as an avoided energy cost to retailers with an estimate adopted for 2015 of 0.05 c/kWh.

The energy value of embedded generation has been calculated as a weighted average of the forecast spot market prices for Victoria in 2015, which includes a forecast spot market price for each half hour period of 2015. The set of forecast spot market prices was prepared by ACIL Allen Consulting using its *PowerMark* model. Like all such forecasts, it is based on normal weather conditions, forecast electricity demand and the anticipated available generation capacity, for each period.

The weights used for averaging the spot market prices represent the relative amount of solar photovoltaic (PV) net exports which can be attributed to each half-hour period over the year. These weights represent the time-profile of small embedded generator net exports over the year. Previously, the Commission used the average time-profile of production from a standard north-facing PV unit in Melbourne as the basis of these weights. This year the Commission used the actual profile PV exports data from a sample of Victorian customers.

By applying the outlined methodology, the Commission has determined the minimum energy value of embedded generation for 2015 to be 6.2 c/kWh (with the carbon price removed).

1 INTRODUCTION

The Essential Services Commission ('Commission') is responsible for determining the minimum rate that a relevant retailer must pay to its customers who are small renewable energy generators for electricity they produce and export into the electricity distribution system. The feed-in tariff (FiT) refers to an amount credited to the generating customer per kilowatt hour (kWh) of electricity it exports to the grid. The purpose of the minimum FiT is to ensure that small renewable energy generators receive a fair and reasonable rate for the electricity they supply for use by others.

The small renewable energy generation facilities to which the minimum FiT applies have capacities of less than 100 kilowatts (kW), and produce electricity using renewable energy sources such as wind, solar, hydro or biomass.[1] At present, most small renewable energy generation in Victoria is from rooftop solar photovoltaic (PV) systems. It has been estimated that over 220,000 homes and businesses in Victoria have had solar PV panels installed (Clean Energy Regulator, 2014). Small-scale wind powered generation is not widespread in Victoria.

In August 2013, the Commission determined the current minimum FiT that has applied since 1 January 2014. This final decision presents the Commission's conclusions on the minimum FiT that will apply in Victoria from 1 January 2015.

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[1] An important exception is that a 'small renewable energy generation facility' does not include a generating facility that is under either the premium solar or transitional feed-in schemes (EIA s 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 (EIA s 40F(2)).

1.1 COMMISSION'S ROLE

Since January 2008, each licensed electricity retailer in Victoria with more than 5,000 electricity customers (relevant retailer) is required to publish and offer generally available renewable energy feed-in terms and conditions. These terms and conditions include the FiT and any other associated terms and conditions. Following amendments in mid-2013, the *Electricity Industry Act 2000* (EIA) requires that the FiT which forms part of the general renewable energy feed-in terms and conditions offered by relevant retailers must not be lower than the minimum FiT determined by the Commission. Before the end of August each year, the Commission determines the minimum FiT to apply in the following calendar year.

The Commission has another regulatory role in relation to general renewable energy feed-in terms and conditions. The Minister administering the EIA can direct the Commission to investigate whether a retailer's general renewable energy feed-in terms and conditions, including prices or other terms and conditions, are fair and reasonable. If they are found not to be fair and reasonable, the Commission must recommend prices, terms and conditions that it considers to be fair and reasonable, and the Minister can impose those prices, terms and conditions on that retailer.

The Commission's regulatory functions relating to FiTs are confined to the generally available renewable energy feed-in terms and conditions. The premium and transitional FiT schemes are outside the scope of the Commission's functions, and of this report.[2]

The Commission is required under s 40FBB of the EIA to determine a rate for the purposes of section 40FBA(b)(i) — this rate being the minimum FiT rate for relevant retailers within their general renewable energy feed-in terms and conditions.

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[2]   These schemes are now closed to new members but will continue to provide beneficial FiT rates for some time to those who are already scheme members.

Under section 40FBB of the EIA, the principal statutory requirement that the Commission must address when determining the minimum FiT is that it must have regard to:

(a)   prices of electricity in the wholesale electricity market, and

(b)   any distribution and transmission losses avoided in Victoria by the supply of small renewable energy generation electricity.

2 REQUIREMENTS & PRINCIPLES

The scope of this review and the Commission's approach to carrying out its task are governed by a number of specific statutory requirements and also some established general principles. The purpose of this chapter is to outline these important requirements and principles.

2.1 APPLICABLE PRICING PRINCIPLES

The general principle that the Commission adopted in its determination of the minimum FiT for 2014 is that small renewable energy sources should receive full credit for the benefits of the electricity they supply to the market. This principle is consistent with the views of the Australian Energy Market Commission (AEMC 2012, 231) and the Victorian Competition and Efficiency Commission (VCEC) in its 2012 inquiry into distributed generation. VCEC concluded that under an 'efficient and fair' FiT, "distributed generators should receive a price that reflects the value of the electricity exported to the grid" (VCEC 2012, 147). This principle was accepted by the Victorian Government (Department of Treasury & Finance 2012). It is also consistent with the Council of Australian Governments' (COAG) principle that FiT rates should be:

> at least equal to the value of that energy in the relevant electricity market and the relevant electricity network it feeds in to, taking into account the time of day during which energy is exported (COAG 2008)

When the FiT is equal to the value of the power supplied by the small renewable energy generator, it avoids cross-subsidies between consumers with and without PV generation capacity. Cross-subsidies to small renewable energy generators may lead to over-investment in generation capacity and cause unnecessary hardship or expense for customers unable to invest in renewable generation (ESC 2013, 13).

In quantifying the benefits associated with electricity fed into the network from small generating consumers, Australian regulators have mainly focused on direct benefits to the retailers supplying those consumers. This is for reasons conveniently summarised by the Queensland Competition Authority (QCA):

> *… setting the retailer-funded feed-in tariff at a rate any higher than the direct financial benefit to retailers would likely result in retailers increasing electricity prices for all customers to cover costs that exceed the benefit they receive. (QCA 2013, 10)*

The Independent Pricing and Regulatory Tribunal (IPART) of NSW referred to this as the 'direct retailer benefit principle'. This does not preclude the possibility that there may be other benefits accruing to other businesses, such as network infrastructure providers. If there are any benefits of that kind, there may be inconsistency between the 'direct retailer benefit principle' and the principle that small renewable energy sources should receive full credit for the benefits that the power they supply provides to the market.

2.2   ISSUES OUTSIDE THE SCOPE OF THE REVIEW

Some submissions to the draft decision reflected on the need for a regulated minimum FiT. For example, Origin Energy felt that the electricity retail market is sufficiently mature not to require a mandated minimum FiT and it would be better if the Commission issued a pricing guide instead. Lumo Energy supported VCEC's recommendation that Victorian FiTs should be market-based, while AGL suggested that the Commission take a more light handed approach to allow retailers to introduce other tariff structures. The Commission's current FiT role continues until the end of 2016, and after this period the Victorian Government may address some of the items outlined by submitters above. For this 2015 period the issues are outside the scope of the review and are not addressed in this final decision.

Other submitters, such as Mr Bolton and Mr Legge, advocated pricing methodologies that are inconsistent with the 'efficient and fair' pricing principle. They argued that the FiT for general tariff PV customers should be equivalent to the retail or grid-supply cost of electricity. Since the 'efficient and fair' pricing principle was specifically adopted by the Victorian Government, these matters are outside the scope of the review and are not addressed in this final decision.

Mr Legge suggested that the Commission should set higher FiT rates for those customers currently on the premium and transitional FiTs who wish to install more PV capacity. The Commission is unable to set more than one FiT rate, making this suggestion unviable.

Victoria's FiT operates as a net metering scheme. This means that the electricity production of a small renewable energy generator is firstly used to meet its own consumption, offsetting purchases from the grid, and in periods when the amount it generates exceeds its electricity consumption, the excess is exported to the grid and attracts the FiT. Some jurisdictions have gross metering schemes in which all PV production attracts the FiT, and there is no offsetting of retail tariffs. Net metering schemes are generally more favourable to energy generating consumers. The Commission has determined the minimum FiT on a net metering basis.

2.3   TIME VARYING FITS

The Commission has previously indicated its intention to consider the opportunities to develop time varying FiTs when determining the 2015 FiT (ESC 2013, 16). However, the Commission has been advised that the EIA requires the Commission to set a single FiT rate for each calendar year, precluding the use of time varying minimum FiTs. Accordingly, time varying FiTs were not considered in this review of the minimum FiT.

Several stakeholders expressed views in relation to time varying FiTs. Origin Energy suggested that:

> *… the most efficient outcome for consumers is to allow retailers to offer tariffs on the basis of the value they attract in the market. As such, in a competitive market like Victoria if there exists an opportunity for a retailer to meaningfully compete for and attract new customers by offering a time varying feed-in-tariff, then that product will be offered.*

The Clean Energy Council (CEC) was disappointed that time varying FiTs could not be considered within the ambit of this review of the minimum FiT and called on the Victorian Government to address the implementation of time-varying minimum FiTs. This is a policy matter and is outside the scope of this review.

Mr Legge suggested that for the "fair and reasonable" criterion to be satisfied, it is important that time-varying minimum FiTs be implemented. Mr Legge questioned why the Commission had been advised that it could only set a single rate, citing section 40FB(1) of the EIA, which defines "general renewable energy feed-in terms and conditions" to include prices "in the plural, not singular". He argued that this is the overarching provision pertaining to the generally available FiT, and therefore the most relevant. However, the Commission's powers in relation to setting the minimum FiT are governed by section 40FBB. This section specifically refers to "a rate". The section also references section 40FBA(b)(i), which refers to "the rate for that year determined by the Commission under 40FBB". The Commission notes Mr Legge's comments, however, pursuant to the EIA it is only empowered to determine one FiT rate for each year.

The Commission notes that energy retailers may have wider scope in relation to how they determine generally available FiTs in accordance with section 40FB. This section does not preclude retailers from offering more than one FiT rate to a customer, provided that each of those rates is not lower than the minimum FiT.

3 METHODOLOGIES

A number of Australian state-based regulators have carried out consultations in regard to FiTs and, by and large, similar methodologies have been adopted for quantifying a fair and reasonable FiT. This chapter explains the methodology adopted by the Commission in its FiT determination for 2015 and discusses submissions received.

3.1 COMMISSION'S METHODOLOGY FOR THE 2015 FIT

In the Commission's assessment of the methodology to set the 2015 minimum FiT, it considered the factors that are relevant to the value of power supplied by small renewable energy generators would include:

- The marginal cost of the equivalent amount of electricity that would otherwise need to be purchased from central generators.
- The locational value of electricity produced close to the final consumers compared to relatively distant central generators.

The marginal cost of obtaining the same amount of energy for the same market from alternative sources, is referred to as the avoided energy cost of small-scale generation. It is based on the cost of purchasing the same amounts of energy, at the same times, from central generators via the electricity pool.

In its August 2013 determination of the minimum FiT to apply in 2014, the Commission adopted a methodology which was consistent with the 'wholesale price plus' approach previously recommended by VCEC (2012). The Commission included the value of electricity in the wholesale market and avoided line losses, as combined in the following formula:

(3.1)   FiT = Loss factor $\times \sum w_h p_h$

where h indicates the ordered half-hourly periods over the year, w is the set of weights used to represent the proportion of annual solar PV exports which occurs in period h, and p refers to the forecast electricity pool price in period h (ESC 2013, 30). In this formula, the loss factor is a locational benefit of small renewable energy compared to that produced by central generators.

The method described by equation (3.1) is also consistent with the 'efficient and fair' principle identified by VCEC and the statutory requirements. The Commission proposed this methodology in the draft decision. A number of submissions to this review, including from AGL and Origin Energy, supported this methodology. The Commission considers that this method remains appropriate for determining the 2015 minimum FiT.

The following sections detail the differences between the Commission's methodologies for setting the 2014 and 2015 minimum FiTs.

3.2   COMPARISON WITH OTHER JURISDICTIONS

Several state-based regulators have determined FiTs or provided guidance in relation to a fair and reasonable FiT range. In general, they have adopted similar approaches, although there are some differences due to the specifics of regulatory roles and terms of reference. The regulatory approach to FiTs is normally based on retailers' avoided energy costs, which is the cost of buying equivalent amounts of electricity at equivalent times from the pool, including adjustment for line losses.

The regulators have been consistent in not including any savings in relation to the following types of costs when quantifying the FiT:

- *network costs:* which are the charges that retailers pay to electricity distributors for using the transmission and distribution systems

- *hedging costs:* the average costs incurred by retailers in managing risks associated with electricity pool price volatility

- *green scheme costs:* such as the cost of obtaining certificates to satisfy obligations under Commonwealth and state renewable energy and energy efficiency quota schemes

- *retailer costs:* including the direct costs of operating the retail business and the commercial return to investment and risk.

The Commission reached the same conclusions on these matters when determining the Victorian minimum FiT for 2014. Similarly, like other regulators, the Commission rejected proposals to include in the FiT the claimed wider benefits of feed-in electricity associated with a 'merit order effect' in relation to average electricity prices. In its submission, the Alternative Technology Association (ATA) reiterated these claimed wider benefits of distributed generation at the wholesale level. The Commission is not persuaded that the positions it reached on these matters in its 2014 decision on the minimum FiT, and in the draft decision in this review, need to be re-examined given the lack of supporting material in the ATA submission.

With regard to network infrastructure costs, Australian regulators have generally found that there is an insufficient basis to allow for any avoided costs of this kind associated with PV electricity exports. When determining the 2014 minimum FiT, the Commission observed that electricity produced by small renewable energy generators is not carried on the transmission system, which might imply that potentially there are avoided transmission costs. However, the Commission concluded that any benefits of this kind had not been substantiated. Submissions relating to avoided network costs are discussed in section 3.7.

One important difference between regulatory methods of determining the value of feed-in electricity relates to the appropriate set of weights to be used in equation (3.1) for averaging wholesale electricity prices. In Victoria, almost all small customers now have interval metering, including all small renewable energy generators. By comparison, in some other states only a small proportion of customers have interval metering. Because of these different metering arrangements there are different wholesale electricity market settlement processes and hence the calculation of retailers' avoided cost is different. In Victoria, the appropriate set of weights is given by the aggregate PV export profile (see ESC 2013, 26). In South Australia and Queensland, settlements for small customers are mainly based on the Net System Load Profile (NSLP), and the regulators in those states have used that profile for calculating retailers' avoided energy cost. In New South Wales, IPART has used both methods.

Two changes have been made to the methodology previously used by the Commission. These changes are:

- **the calculation of the loss factor**: This topic is discussed in section 3.5.

- **the inclusion of market operator fees**: Most other jurisdictions have included market operator fees as an avoided cost to retailers because these fees are levied against the retailers' electricity purchases from the pool. The Commission previously considered this to be a comparatively immaterial item (ESC 2013, 21), but as the Commission is adopting a more precise calculation of the FiT in this review, it is appropriate to include market operator fees. This approach was supported in Origin Energy's submission. This topic is discussed further in section 3.6.

3.3 FORECAST WHOLESALE ELECTRICITY PRICES

An important element of setting the minimum FiT is the forecast value of electricity in the wholesale market in each period of each day of the forecast year. For 2014, the Commission used a forecast produced by ACIL Allen Consulting using its *PowerMark* electricity market model. ACIL Allen's forecast of electricity prices for the current FiT review is provided in table 3.1.

TABLE 3.1   AVERAGE VICTORIAN WHOLESALE ELECTRICITY PRICE FORECASTS ($/MWh)[1]

	2014 with carbon price	2014 no carbon price	2015 with carbon price	2015 no carbon price
Forecast May 2013	67.66	54.95	..	..
Forecast Feb 2014	58.88	48.00	57.32	44.50

Note: 1. Prices are simple (un-weighted) averages for each calendar year.
Source: ACIL Allen Consulting 2014.

Forecasts based on market models have the benefit that they can take into account up-to-date information about significant changes in demand or supply conditions likely to affect the electricity market in 2015. This forecasting method also permits forecasting under alternative scenarios. The forecasts in table 3.1 are presented for the alternative scenarios relating to the abolition of the carbon price.

Given that the carbon price has been removed, only the 'no carbon price' scenario is now relevant. The 'with carbon price' scenarios are retained for comparison purposes only.

Table 3.1 shows that ACIL Allen Consulting's current forecast for the unweighted average 2014 electricity pool price in Victoria, on a carbon inclusive basis, is $58.88/MWh, which is a substantial reduction from its May 2013 forecast of $67.66/MWh. This reflects a revised outlook for demand and supply in the NEM. The current forecast for the Victorian pool price in 2015, again on a carbon inclusive basis, is $57.32/MWh, indicating the supply and demand conditions in 2015 are expected to be broadly similar to 2014. The removal of the carbon price is forecast to reduce the average electricity price in 2015 to $44.50/MWh, or by 22 per cent. The forecast confidence intervals provided by ACIL Allen indicate there is an 80 per cent likelihood that the 2015 average pool price will be within 91 to 117 per cent of the forecast price, which, on an ex-carbon basis, means within the range $40 to $52 per MWh.

An alternative to the market model-based method of forecasting electricity prices is to use the strike prices within publicly traded futures contracts (swaps and caps).[3] This method has been advocated by the AEMC because it regards forecasts based on futures prices as generally producing better energy price forecasts (AEMC 2013, iii). However, a futures-based price forecast does not permit the testing of alternative scenarios, as the swap price reflects the market's expectations regarding the abolition of the carbon price scheme.

Table 3.2 shows that the average Victorian pool price for 2015 predicted by the base swap price is comparatively low at $39.58/MWh. The price levels shown suggest the carbon price repeal was expected.

A regression analysis of actual quarterly electricity pool prices in four NEM jurisdictions against base swap prices relating to the same periods was carried out by Economic Insights on behalf of the Commission. This analysis found that futures-based forecasts of the electricity pool price are unbiased predictors, but provide little information about likely future pool price levels, as evident from the large regression model standard errors. While it may be possible to improve the forecasting ability of such models, at the present stage the Commission prefers market model-based forecasts and has used the ACIL Allen ex-carbon forecast for Victorian electricity pool prices in 2015. The ACIL Allen forecast was also provided for each hourly period of the 2015 calendar year, which is used in equation (3.1).

No submissions were received on the use of futures pricing to determine the 2015 minimum FiT.

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[3]   ASX-Energy operates a publicly traded market for wholesale electricity market futures.

TABLE 3.2 BASE SWAP ELECTRICITY FUTURES PRICES VICTORIA
($/MWh)

Forecast year & quarter	Transaction year & quarter	Quarters ahead	Average base swap price
2015:1	2013:4	5	44.87
2015:2	2013:4	6	37.09
2015:3	2013:4	7	37.26
2015:4	2013:4	8	36.70
2015			39.58[1]

Note: 1. Weighted average using the average share of Victorian NEM demand occurring in each quarter of the 15 years ending December 2013.

Data Source: ASX-Energy.

3.4 ELECTRICITY FEED-IN PROFILES

As previously mentioned, the appropriate set of weights to use in formula (3.1) when applied to the Victorian context differs from most other states due to the extensive adoption of interval metering. Given the pool settlement procedures applied to interval metered customers, the appropriate set of weights is based on the average time-profile of PV net exports. Previously, when determining the minimum FiT for 2014, the Commission based its calculations on the typical electricity production profile of a 1 kW north-facing PV unit in Melbourne.

For the purpose of applying the same method, the Commission obtained an additional year of data on the typical electricity production profile of a 1 kW north-facing PV unit for 2012-13. This data has been used to calculate a nine-year average PV production profile (ending in 2012-13), rather than the eight-year average (ending in 2011-12) used previously. Extending the period of averaging by one year to include the latest data makes only a small difference to the results obtained.

As observed by EnergyAustralia in its submission to the 2014 draft decision, it may be preferable to use data for the actual time-profile of small embedded generator net exports. For this review, the Commission gathered net export records for a random sample of 1163 small renewable energy generators in 2013 from Victoria's electricity distribution businesses. This data has been consolidated and a summary of actual PV exports on an average day in each month is shown in figure 3.1. These profiles are normalised to an annual total of 1 kWh to provide a suitable set of weights for calculating the average value of FiT exports.

Figure 3.1 shows that PV exports tend to be higher in summer months because the hours and intensity of sunshine is at its greatest. This is an important reason why the value of PV exports tends to be slightly higher than the unweighted average electricity pool price.

FIGURE 3.1   ACTUAL AVERAGE PV EXPORT PROFILES VICTORIA
(kWh per consumer on Average Day per Month)
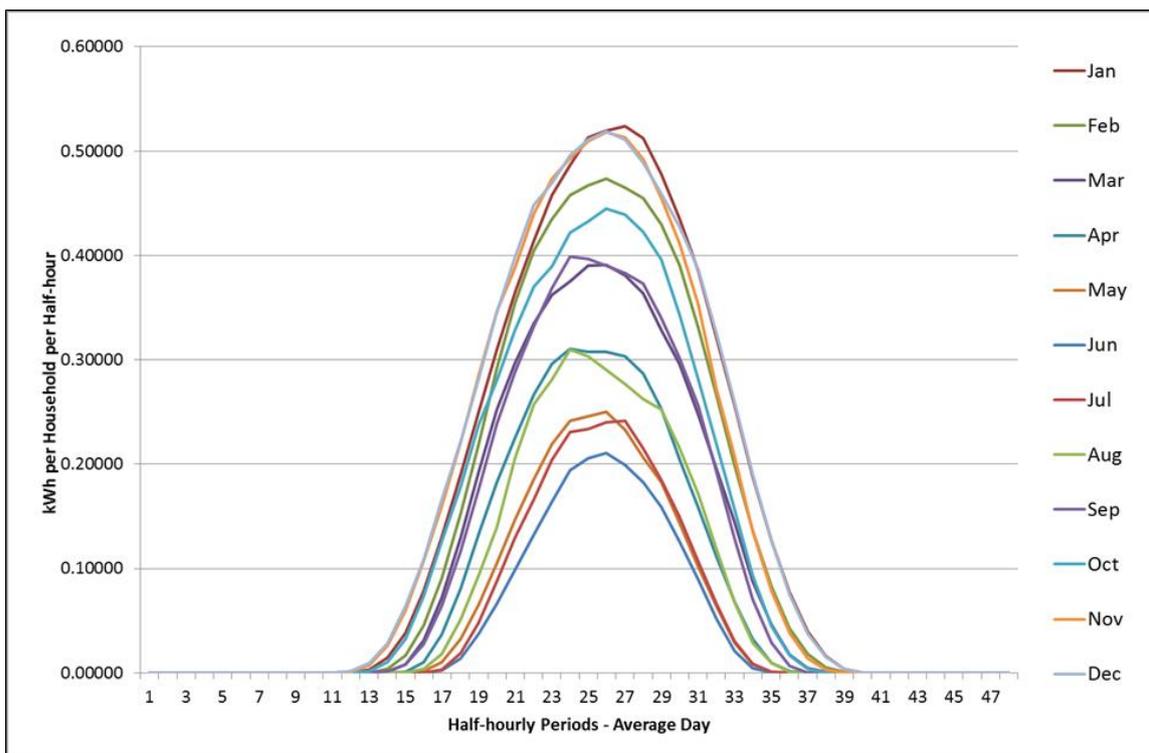
Data source: De-identified consumption and export records provided by Victorian electricity distributors.

The AGL submission supported the use of the actual solar export profiles rather than a typical profile from a 1 kW PV installation in Melbourne. However, AGL noted this should be reassessed in future FiT reviews to ensure technology neutrality, since the FiT is applicable to all forms of renewable generation with capacity of up to 100 kW, not just solar energy.

The Commission has decided to use the actual profile of small embedded generator net exports for determining the 2015 minimum FiT, rather than the profile of production of a typical 1kW north-facing PV unit. For comparison purposes, the value of small renewable exports calculated in chapter 4 uses both methods detailed in this section.

3.5 AVOIDED LINE LOSSES

Line losses are taken into account when determining the FiT by applying a loss factor to the weighted average wholesale price of electricity, as shown in formula (3.1). The wholesale electricity price published by the Australian Energy Market Operator (AEMO) is determined at the Regional Reference Node (RRN), and this price includes transmission losses between generators and the RRN.[4] The loss factor used in formula (3.1) 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.[5]

- Distribution line losses are measured by distribution loss factors (DLFs), which are estimated by each distribution network service provider and published by AEMO.[6]

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[4] In Victoria the RRN is at Thomastown.

[5] 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).

[6] 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.

Previously, the Commission included only distribution losses in the loss factor while some other regulators have included transmission losses between the RRN and terminal stations, which are the off-take points of the transmission system. These may be positive or negative depending on the location of those off-take points relative to the RRN and the generating plants. As noted above, transmission line losses between the generation plants and the RRN are included in the quoted pool price. Transmission losses downstream of the RRN adjust the calculated line losses to their actual levels. Although in aggregate they are comparatively small, their inclusion in the analysis serves to better align the Commission's methodology with those of other regulators.

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

(3.2)   Loss factor = MLF × DLF

To date a uniform minimum FiT has applied throughout Victoria, in which case the MLF and DLF used in formula (3.2) are weighted averages for all locations in the State.

The above formula is consistent with the 'direct retailer benefit principle' because it reflects the way that retailers pay for electricity via the settlements process managed by AEMO. The amount of electricity that retailers pay for in each financial settlement period is based on the metered loads of their customers adjusted for the relevant loss factors so that it equals the amount delivered to them at the RRN (see AEMO 2012).

This adjustment for loss factors also acknowledges that distributed generation tends to reduce average network line losses because the electricity exported by small renewable energy generators is usually consumed by nearby customers, resulting in smaller line losses than would have occurred with supply from the grid. Several regulators have examined whether reduced line losses of this kind represent additional benefits flowing to other consumers that ought to be included in the FiT. The Commission agrees with the QCA when it concluded that the benefits of reduced line losses are already fully taken into account through the loss factors applied to wholesale electricity purchases from the NEM, and:

> *… attempting to quantify the benefit of reduced loss factors, and returning it to PV customers through a feed-in tariff, would mean that the benefit was actually double-counted and would result in an overstated feed-in value for PV exports (QCA 2013, 15).*

Equation (3.2) has been quantified as follows. AEMO estimates the MLF for every transmission network connection point (AEMO 2013a, 36–37). Using this data, we estimate the weighted average MLF in 2013-14 for Victorian mass-market customers at 1.0093.[7] DLFs are estimated by the distribution network service providers in each zone for each line voltage class and published by AEMO (2013b). Using these published DLFs, we estimate that for a low voltage customer on Victoria's short sub-transmission systems, the weighted average DLF for 2013-14 was 1.0602.[8] That is, about six per cent of the electricity supplied into the distribution system is lost before it reaches the customer. The overall loss factor is therefore (1.0093 × 1.0602) = 1.0701. For the reasons already given, the Commission considers this to be the appropriate loss factor to apply in equation (3.1).

No submissions were received in relation to this issue.

3.6   MARKET OPERATOR FEES

The avoided cost of market operator fees has been estimated at between 0.035 and 0.05 c/kWh by SKM-MMA (2013, 11), and at 0.07 c/kWh by QCA (2013, 25). The Commission has adopted an estimate of 0.05 c/kWh, as per its draft decision.

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[7]   The weights used in this calculation are the total billing units (MW) of mass market customers at each terminal station used for the levying the Transmission Use of System (TUoS) location charge. This data was provided by AEMO to the Commission on a confidential basis.

[8]   The weights used in this calculation were the numbers of customers in each distribution zone.

3.7   OTHER CONSIDERATIONS

Some aspects of the benefits of small renewable energy generation remain uncertain. Here we briefly mention some questions that are closely related to the contribution of this source of energy to system-wide supply during periods when network load is at its greatest.

One question is whether solar PV exports may have higher value when there is more certainty over its contribution to peak-day supply. For example, ESCOSA noted that to "the extent that a portion of total installed solar PV generation can be relied upon to meet customer demand at any point in time, the total amount of hedge cover required by a retailer will be reduced by that portion" (ESCOSA 2012, 39). Realising value of this kind may depend on innovations in retailer contracts with their PV customers.

Another question is whether there are any network benefits associated with small renewable energy generation, particularly since energy exports from distributed generators are not carried on the transmission network. The Commission has previously observed that avoided costs of this kind have yet to be established. The ATA submitted that "the transmission benefits of DG [distributed generation] to all consumers warrants greater attention". The ATA suggested it "is reasonable that DG proponents should be partially remunerated for the material saving to the DNSP [distribution network service provider] and other consumers of reduced transmission charges (via avoided Transmission Use of System (TUoS))."

Australian regulators have generally not recognised any specific network benefits associated with small renewable energy generation. IPART of NSW suggested that if there are any network benefits (or costs) of small-scale PV generation, they should be directed to PV customers, but only where consistent with the 'direct retailer benefit principle' (IPART 2012). The Commission agrees that, if there are any network benefits, it would not be feasible to include them in the minimum FiT unless they were reflected in network charges.

The ATA observed that SP AusNet "currently pays consumers (technically speaking they pay retailers who may or may not pass this through to consumers) a tariff of 4.1 c/kWh for all PV exported to the network between November to March." The Commission has confirmed that SP AusNet is the only Victorian distribution business that offers this type of payment and understands that the payment only partially compensates for the avoided TUoS. The Commission does not have any information that substantiates the avoided TUoS component of the SP AusNet payment and has no information on the level of avoided TUoS, if any, for the other distribution zones. The Commission considers that to appropriately and accurately substantiate any avoided TUoS as an input into a Victoria-wide minimum FiT rate would require consideration of zone-specific distribution information, such as PV location and load flow data. At present, the Commission does not have access to such information. In addition, the Commission is not aware of any established methodology that can accurately estimate avoided TUoS. For these reasons, the Commission has not included avoided TUoS in the calculation of the minimum FiT for 2015.

Whether electricity distribution businesses should be obliged to pass through any benefit of reduced transmission charges associated with embedded generation to the retailers of the customers that give rise to that benefit, is a question that can only be addressed by the national rule-making and regulatory bodies responsible for network tariffs.

4   AVOIDED COST CALCULATIONS

The previous chapter explained the methodologies and data inputs used to calculate the value of embedded generation exports. This chapter outlines the impacts of the main changes in inputs and methods since the previous review, including:

- the revised outlook for electricity prices due to changes in supply and demand conditions in the NEM;

- the use of actual PV export profiles rather than a standard production profile of a 1kW north-facing unit in Melbourne;

- revision to the calculation of the loss factor; and

- inclusion of the market operator fee.

This chapter also quantifies the value of embedded generation exports and explains the calculation of the minimum FiT for 2015.

Given that the carbon price has been removed, only the 'no carbon price' scenario is now relevant. The 'with carbon price' scenarios are retained for comparison purposes only.

4.1   SCENARIO ANALYSIS

In Table 4.1, the average value of feed-in electricity is shown for 2014 and 2015 under some different assumptions. The 'Solar Export Profile - Actual' refers to the export profile derived from PV customer export data provided by the electricity distribution network service providers. The 'Standard Production Profile' refers to the nine-year average for half-hourly production of a 1 kW north-facing unit.

The first row of the table is based on the electricity price forecast used to determine the 2014 minimum FiT. The avoided cost estimate of 7.78 c/kWh (standard production profile scenario) broadly corresponds to the Commission's previous estimate of 7.62 c/kWh. The difference is because:

- a nine-year average production profile is used rather than the eight-year average used previously (which raises the estimate from 7.62 c/kWh to 7.66 c/kWh),

- the loss factor of 1.07 is used, rather than 1.06 used previously (which raises the estimate from 7.66 c/kWh to 7.73 c/kWh), and

- the inclusion of market operator fees (which raises the estimate from 7.73 c/kWh to 7.78 c/kWh).

TABLE 4.1   VALUE OF FEED-IN ELECTRICITY
(c/kWh)

Electricity Price Forecast (ACIL Allen)	Forecast for Year	Carbon Pricing Scenario	Solar Export Profiles	
			Actual	Standard Production Profile
May 2013 Forecast	2014	With carbon	7.77	7.78
Feb 2014 Forecast	2014	With carbon	7.33	7.42
	2015	With carbon	7.35	7.39
	2015	**Without carbon**	**6.15**	**6.28**

Source: Commission estimates.

Table 4.1 shows that adopting the actual solar export profile rather than the standard production profile has not significantly affected the estimated value of PV exports. The two major influences are:

- the revised market outlook which is reflected in the latest ACIL Allen electricity price forecast, which reduces the value of feed-in electricity (in 2014), using the actual solar export profile, from 7.77 c/kWh to 7.33 c/kWh — a reduction of 0.44 c/kWh

- the removal of the carbon price which reduces the value of feed-in electricity (in 2015), using the actual solar export profile, from 7.35 c/kWh to 6.15 c/kWh — a reduction of 1.20 c/kWh.

In determining the 2014 FiT, the Commission concluded that it could determine the minimum FiT from within the range of reasonable estimates (ESC 2013, 33). While there may be a degree of volatility in the estimates of the value of small renewable energy generation electricity from year-to-year, the Commission considers that these forecasts are the best estimates available. Further, the actual PV export profiles used in this estimation provide more certainty than in the previous review. Consistent with this approach, and that taken in other jurisdictions, table 4.2 shows the results of the Commission's method of calculating the value of small renewable energy generation electricity generation for 2015.

TABLE 4.2: VALUE OF SMALL RENEWABLE ENERGY GENERATION ELECTRICITY

Avoided Cost	Contribution to FiT Rate (cents per kWh)
Wholesale Energy Value	5.70
Combined Line Losses	0.40
Market Operator Fees	0.05
Total	**6.15**

The Commission proposes to adopt the forecast FiT value of 6.2 c/kWh, which is the rounded estimate of the value of feed-in electricity in 2015, using the actual solar export profile, and with no carbon price.

The Commission's final decision is to adopt a minimum FiT of 6.2 c/kWh to apply from 1 January 2015.

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