Response to VaDER Methodology Study Consultation Draft Report

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Introduction

Frontier Economics has been engaged by AusNet Services to provide our views on the consultation draft report released by CSIRO and CutlerMerz on the value of distributed energy resources[1] (**VaDER Consultation Draft Report**).

Summary of our views on using the FiT to value additional solar exports

AusNet Services has proposed using the Victorian minimum single rate feed in tariff (FiT), determined by the Essential Services Commission (ESC), as a proxy for the value of the benefit of removing constraints on solar exports on its network.

This is a reasonable approach that is consistent with what we consider to be the appropriate methods outlined in the VaDER Consultation Draft Report. Specifically, we note the following:

- The wholesale component of FiT is calculated using essentially the same methodology that the VaDER Consultation Draft Report recommends for calculating the annual wholesale market value of DER under the shorthand Running Cost Method.
- The key difference between the FiT and the Running Cost Method is that the VaDER Consultation Draft Report recommends updating the initial annual value from the Running Cost Method by applying an annual index representing the change in the total cost of large-scale solar PV. This approach is questionable given there is no reason to think that half-hourly wholesale electricity costs (which are the basis for both the FiT and the Running Cost Method) will move in line with the movements in the total cost of large-scale solar PV.
- Our view is that assuming the value of DER under the Running Cost Method remains constant over time is preferable to an approach that changes the forecast value in a way that does not have any sound rationale or basis. While the value of DER will change over time, the only reasonable approach to forecasting how the value of DER will change is the longhand market modelling approach.

1 Koerner M, Graham P, Spak B, Walton F, Kerin R (2020) *Value of Distributed Energy Resources: Methodology Study: Consultation Draft Report*. CutlerMerz, CSIRO, Australia.

- The Running Cost Method is preferable to the Total Cost Method. The Total Cost Method fails to adequately account for the timing of electricity supply (including DER supply to the grid), which is a key driver of the value of DER. One of the key advantages of the longhand market modelling approach is that it can accurately capture the timing of electricity supply; a shorthand method that also captures the timing of electricity supply should be preferred to one that does not.
- There are likely to be material issues with attempting to sensibly quantify the costs of changes in DER investment. The issues are:
  - It is difficult to appropriately attribute a share of costs and benefits to the provision of DER services, when the DER investment decisions are driven by a range of factors other than providing DER services.
  - The increasing range and complexity of DER investments is likely to exacerbate the difficulty of attributing an appropriate share of costs and benefits to the provision of DER services.
  - Or alternatively including all costs and benefits of DER, including intangible benefits.
- Given this, an appropriate approach would be to presume **that network investments do not directly result in increased costs of DER investment**. This reflects the likelihood that network investments will not directly drive DER investment and that there are significant intangible benefits to customer from their DER investments.
- It would be appropriate to define clear criteria for the circumstances in which this presumption should *not* apply. Only when these criteria are met should network businesses account for the change in DER investment in their assessment. In these cases, it would be appropriate to:
  - establish a framework for forecasting a change in DER that recognises that many of the drivers of DER investment are not related to the capability of the network
  - establish a rule of thumb to account for the value of intangible benefits of DER to ensure that both the relevant costs and benefits are counted.

Responses to questions

CSIRO and CutlerMerz seek feedback on the following specific questions in the VaDER Consultation Draft Report:

1. Whether the value streams we have considered are complete;
2. Whether we have appropriately defined the system boundaries, and therefore costs and benefits, which AER is able to consider;
3. Whether the overall methodology proposed is fit for purpose (practical, proportionate, repeatable, flexible and likely to give rise to near optimal levels of investment);
4. Whether the individual methods developed are fit for purpose (practical, proportionate, repeatable, flexible and likely to give rise to near optimal levels of investment); and
5. Whether you agree that the recommendations provided are likely to improve the ability of network businesses to identify optimal investment in DER integration.

We address each of these specific questions in the sections that follow.

Are the value streams considered complete?

The VaDER Consultation Draft Report refers to three different type of services that may be enabled by investment in DER integration:

- **Variable energy** – energy generated by passive DER systems.
- **Flexible energy** – energy generated by active DER systems.
- **Flexible capacity** – active DER capacity available to provide services to wholesale markets or networks.

It is not clear to us that it is useful to distinguish between flexible energy and flexible capacity provided by DER. Indeed, this distinction may result in confusion about DER value streams or the conclusion that the value streams offered by certain DER systems are narrower than they really are.

For instance, in considering the identification of DER value streams in Table 4 of the VaDER Consultation Draft Report there are several value streams that flexible energy can provide that are not currently identified. For instance:

- Flexible energy provided by active DER systems can result in avoided generation capacity investment. For the same reason that *variable energy* can result in avoided generation investment (by supplying electricity at times that utility-scale generation would otherwise be needed to provide electricity) *flexible energy* can result in avoided generation.
- Flexible energy provided by active DER systems can result in avoided transmission and distribution augmentation. For the same reason that *variable energy* can result in avoided network augmentation (by supplying electricity at times that would otherwise require network augmentation) *flexible energy* can result in avoided network augmentation.
- It is not clear what distinction there is between active DER that is providing *flexible capacity* (which means it can provide essential system services) and active DER that is providing *flexible energy* but is assumed not to be able to provide essential system services.
- It is not clear why *variable energy* can provide value through avoided replacement or asset derating but *flexible energy* cannot provide that value.

In our view, a simpler distinction would be between passive DER systems and active DER systems. Considering Table 4, our view would be that active DER systems can provide all of the value streams identified in Table 4 while passive DER systems can provide the value streams currently identified for variable energy.

This simpler distinction will avoid the need for network businesses to distinguish between identifying active DER as providing either flexible energy or flexible capacity and therefore potentially valuing only the subset of benefit types currently attributed to each of these services. If active DER can provide all these services, as we believe it can, we see no reason to limit the attribution of value streams to active DER.

Are the system boundaries appropriate?

The VaDER Consultation Draft Report identifies three potential system boundaries for determining which costs and benefits to include in the assessment:

- **To the meter** – at the boundary of the electricity system, thereby excluding the costs of any behind the meter assets.
- **Total electricity system** – extending the boundary to behind the meter, thereby including the costs of behind the meter assets.
- **Society** – including all costs and benefits to society.

In principle, we recognise the logic of assessing costs and benefits for the total electricity system. If a network investment will have the *direct* effect of changing DER investment, then the costs of that investment should be assessed along with its benefits, and along with costs and benefits for the rest of the system.

In practice, however, there are likely to be material issues with attempting to appropriately quantify the costs of changes in DER investment. The issues are:

- It is difficult to appropriately attribute a share of costs and benefits to the provision of DER services, when the DER investment decisions are driven by a range of factors other than providing DER services.
- The increasing range and complexity of DER investments is likely to exacerbate the difficulty of attributing an appropriate share of costs and benefits to the provision of DER services.
- Or alternatively including all costs and benefits of DER, including intangible benefits.

These issues are explained below.

First, even with rooftop solar PV investments, it is likely that issues of cost attribution arise. This is because we expect that for many customers that install rooftop solar PV the decision is driven, at least in part, by reasons other than lowering their electricity costs (including through savings associated with providing DER services to the grid). This could include the value that they place on consuming renewable electricity and the value they place on consuming renewable electricity that they have generated themselves. Survey responses reported by Energy Consumers Australia support this view, as shown in **Figure 1**. The survey responses reveal that purchase intentions for both solar panels and battery storage systems are not just driven by saving money, but are also driven by becoming less dependent on mains electricity, making more efficient use of energy and protecting the environment.

Figure 1: Consumer attitudes to solar panels and batteries

Source: Energy Consumers Australia, Consumer Sentiment and Behaviour, *31/7/2019.*

Note: Categories 1 through 9 are different customer segments, as identified in ECA's report.

The VaDER Consultation Draft Report seems to suggest that these intangible benefits may be true for early adopter markets (such as batteries), but presumably are less likely for established markets (such as rooftop solar PV). It is not clear to us why this would be the case, and the survey data presented above indicates that it is not the case. But more importantly, it is extremely difficult to know or to estimate what intangible benefits customers receive from investments in DER.

Second, it is likely that DER will increasingly be provided not through investments in discrete and stand-alone assets (such as rooftop solar PV panels), but through changes to the way that customers behave or investments in assets that provide a range of services beyond supplying electricity to the grid. For instance, the VaDER Consultation Draft Report recognises that DER may involve customers changing the way that they charge their Electric Vehicles (EVs) or discharging the battery in their EV into the grid. However, customers are unlikely to invest in an EV specifically to provide DER services, and it would be inappropriate to include the cost of the EV in an assessment of the costs and benefits of increased DER. But it is unclear what practical alternative there is. Similarly, customers are unlikely to invest in home energy management technologies specifically to provide DER services. Without a practical approach to estimate the costs of these kinds of DER, and to attribute these costs to the provision of DER services, the outcome of an approach that seeks to account for the costs of DER investment will be that different forms of DER are treated differently in the assessment.

Given that DER is likely to increasingly be provided from assets or behaviours that do provide significant intangible benefits, an approach that includes all costs of DER, but does not account for these intangible benefits, would be problematic.

Finally, customers that invest in DER do not do so primarily as a result of network conditions. The most common form of DER is solar PV and it is well established that the principle benefit to customers of installing solar PV is that it enables them to reduce their imports of electricity (for which they pay a retail tariff that is typically in the range of 20 to 30 c/kWh). In comparison, the benefit to customers of exporting excess electricity (for which they receive a FiT that is typically in the range of 6 to 10 c/kWh) is much smaller. A similar logic is expected to apply for investments in batteries; by storing excess generation from rooftop solar PV and using this electricity later in the evening, batteries enable customers to further reduce their imports of electricity. Customers will effectively use batteries to arbitrage the difference between the retail tariff and the FiT.

In our view, the ability of the network to enable exports is not a key driver of the financial return of investing in solar PV for most customers, and will be even less important to the financial return of customers also investing in batteries. For this reason, we expect that for many network investment decisions, DER investment in the Base Case and the credible options that are assessed will be the same.

For these reasons we think a sensible approach would be to presume **that network investments do not directly result in increased costs of DER investment**. This reflects the likelihood that network investments will not directly drive DER investment and that there are significant intangible benefits to customer from their DER investments.

It would be a sensible approach to define clear criteria for the circumstances in which this presumption should *not* apply. Only when these criteria are met should network businesses account for the change in DER investment in their assessment. In these cases, it would be appropriate to:

- establish a framework for forecasting a change in DER that recognises that many of the drivers of DER investment are not related to the capability of the network
- establish a rule of thumb to account for the value of intangible benefits of DER to ensure that both the relevant costs and benefits are counted.

Is the overall methodology fit for purpose?

The VaDER Consultation Draft Report sets out a methodology that compares the total electricity system costs as a result of increasing hosting capacity with the total electricity system costs of not doing so. In broad terms this methodology is reasonable. The issues arise with implementation of this methodology, which is discussed in more detail in response to the other questions.

Are the individual methods developed fit for purpose?

The VaDER Consultation Draft Report proposes both a longhand and shorthand method for quantifying wholesale market benefits:

- The longhand method is the use of electricity market modelling.
- The shorthand method is the use of simple methods that do not require electricity market modelling but make use of simpler analysis and data either created by the network business or in the public domain.

In principle these two approaches are sensible. Undertaking electricity market modelling is complex and time-consuming. We think it makes sense to only use this approach when that complexity and time is justified.

However, the criteria in the VaDER Consultation Draft Report for when the longhand or shorthand methods should be used could be clearer:

- Does the investment need to meet each of these criteria for the shorthand method to be appropriate, or does the investment need only meet one of these criteria?
- What qualifies as an investment that is relatively small? A dollar value threshold would be helpful.
- How does a network assess whether the investment is likely to give rise to a small amount of DER capacity relative to the energy market that it will impact? What energy market is used for this comparison – the NEM as a whole, the network's region within the NEM, the network itself? And how does a network business forecast the likely increase in DER capacity? As discussed previously, it would be appropriate to establish a framework for forecasting a change in DER that recognises that many of the drivers of DER investment are not related to the capability of the network.

Total Cost Method

Our view is that the Total Cost Method would be problematic to implement. The key issues with the method are the following:

- The criteria for using it are vague:
  - What does it mean for DER to be available over an extended period?
  - How do networks judge whether additional DER is needed in that generation region? Is it sufficient for additional capacity or additional electricity to be forecast to be required? At what lead time is it necessary for this requirement for additional capacity or additional electricity to emerge?
  - How do networks judge that an annual energy profile is a reasonable substitute for the relevant standard solution? Even relatively small differences in profiles can result in very large differences in value to the system, and accounting for these differences is not simple. The VaDER Consultation Draft Report suggests comparing annual capacity factor but our view, discussed below, is that this is not a very useful test of the relative value of different sources of generation. The most practical approach to capturing these differences is by

using the Running Cost Method, which suggests to us that the Running Cost Method is simply a more appropriate method and that the Total Cost Method does not usefully assist in quantifying generation sector benefits.

- It is hard to adjust for differences between energy profiles of the additional DER and the standard solution. The VaDER Consultation Draft Report suggests that the ratio of annual capacity factors should be used to discount benefits. However, the ratio of annual capacity factors only tells us about how much generation is provided in a year, and tells us nothing about the time at which the generation is provided. Yet the time at which generation is provided is a key driver of its value. To give one example, the capacity factor of an east facing solar panel and a west facing solar panel might be very similar, but the value of the west facing solar panel is much higher because of higher costs of providing electricity in the afternoon. We also note that as DER becomes more complex – including batteries, EVs, home energy management technologies, and so on – it will become more and more difficult to sensibly compare DER to a 'standard solution'. Even a standard household battery is likely to operate differently to a standard utility-scale battery because of the very different price signals that the two batteries are responding to (retail prices for the household battery but wholesale prices for the utility-scale battery).

Running Cost Method

Our view is that the Running Cost Method will better reflect the benefit of DER. The reason is that it explicitly accounts for the timing at which DER is available, while the Total Cost Method does not.

However, there are issues with the proposed approach under the Running Cost Method to adjusting recent historical half hourly prices over time. The VaDER Consultation Draft Report suggests that an index that reflects the changes in costs of electricity supply at the relevant time period should be used, and that for rooftop solar PV an index of the change in the total costs of large-scale solar should be used.

There is also no reason to expect that half-hourly wholesale prices during periods in which solar PV is generating will change over time in line with the total costs of large-scale solar. The half-hourly wholesale prices during periods in which solar PV is generating are determined each half-hour based on the price bid by the marginal generator. These bids typically reflect the short-run marginal cost of generators. In some half-hours the marginal generator may be solar PV, with a marginal cost around zero (or below, if accounting for the benefit of creating large-scale generation certificates (LGCs)). In some half-hours the marginal generator may be coal, with a marginal cost reflecting its coal cost and its variable operating costs. In some half-hours the marginal generator may be gas, with a marginal cost reflecting its gas cost and its variable operating costs. There is no reason to expect that any one of these short-run marginal costs will move over time in line with an index of the change in the total costs of large-scale solar. Even the short-run marginal cost of solar PV will be unrelated to the total costs of large-scale solar, which mainly consist of capital costs.

Indeed, the VaDER Consultation Draft Report recognises this point in suggesting that "[t]his index should not be used to create a time series of half hourly prices over the future years or decades of the network project. This approach would be feasible but impractical from a data management perspective and potentially non-sensical from an interpretation perspective." We agree that this would be non-sensical, but make the further point that the annual cost is based entirely on the half-hourly prices – adjusting the annual cost in a way that would be non-sensical if applied to the half-hourly prices is just as non-sensical, and not reporting the half-hourly prices does not change this.

The expectation in the VaDER Consultation Draft Report seems to be that the value of DER (at least the value of electricity provided by solar PV) should fall over time. Presumably the hypothesis is that with increasing amounts of solar PV on the system, half hourly prices at times of solar PV generation will fall over time and that this should be reflected in the Running Cost Method.

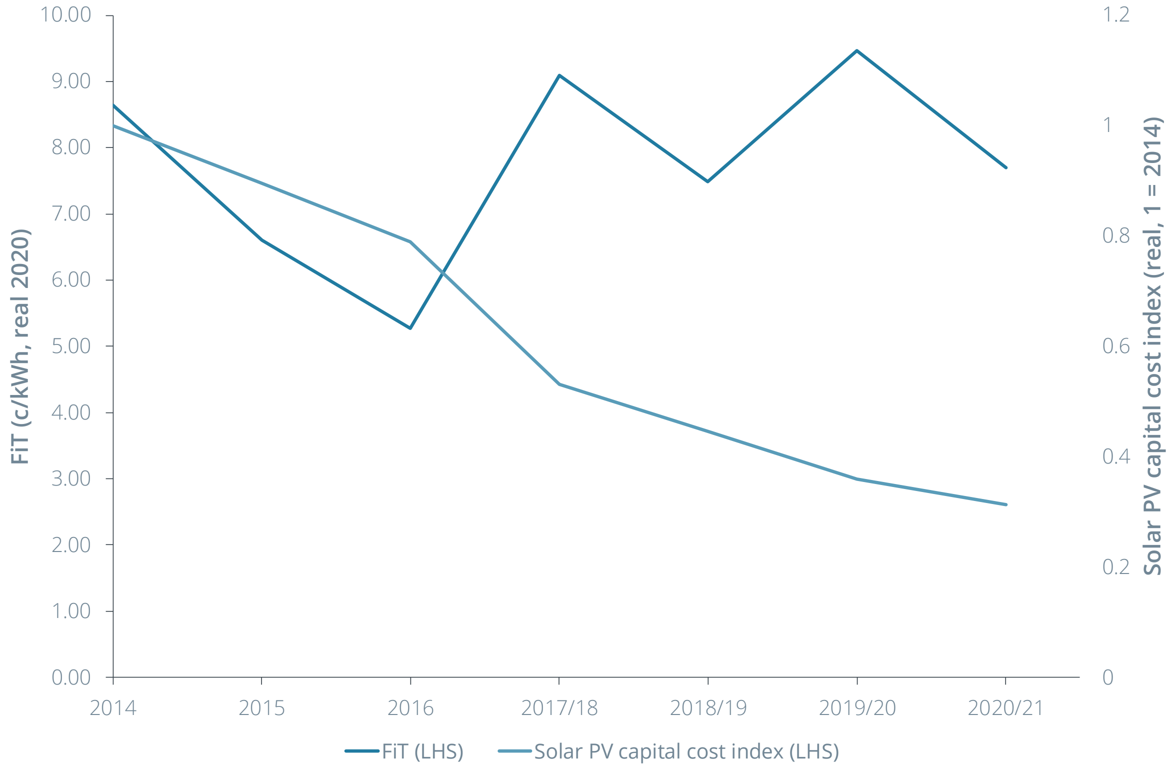
While we agree that it would be ideal to have a robust estimate of half-hourly prices over the life of DER (and note this is one advantage of what the VaDER Consultation Draft Report refers to as the longhand method) we would caution against an hypothesis that half hourly prices at times of solar PV generation will fall over time. There are any number of factors that drive wholesale electricity prices, including fuel costs, generation retirement, generation and storage investment and changing patterns of demand. We agree that additional investment in solar PV generation – all other things being equal – will tend to result in half-hourly prices that are lower in the middle of the day. But all other things are not equal. In particular, increased investment in batteries is likely to have the effect of increasing demand during periods of solar PV generation (as these batteries charge) which may mean that electricity prices during these periods do not fall.

This is evident if we compare over time the minimum FiTs determined by the ESC and an index of the capital cost of large-scale solar, as shown in **Figure 2**. The data series in **Figure 2** are the following:

- The minimum FiT determined by the ESC, excluding the additional 2.5 c/kWh that the ESC has included in the minimum FiT since 2017/18 to account for the avoided social costs of carbon. This means that the FiT values are comparable over time. Each of these FiT values was calculated using an approach that is broadly consistent with the calculation of the first year value under the Running Cost Method. That is, the FiT estimate is calculated based on the weighted average wholesale electricity price for the year, but also includes amounts for losses and, in more recent years, market fees and ancillary services costs.
- The index of the capital cost of large-scale solar is based on capital costs estimates published by AEMO over time. This series actually consists of different large-scale solar technologies – for the initial estimate AEMO only published capital costs for fixed flat plate solar, but by the later estimates AEMO only published capital costs for single axis tracking solar. If we had a series for a consistent solar technology the decline in capital costs would be even larger. The estimated capital cost of large scale solar is a good proxy for the total costs of large-scale solar since capital costs account for the majority of the total costs of large-scale solar.

It is clear from **Figure 2** that there has been a very significant difference in the trajectory over time between the ESC's minimum FiT and AEMO's estimates of solar capital costs. While the ESC's FiT has been volatile over time, there is no clear evidence that it has trended lower over time. In contrast, AEMO's estimates of solar capital costs have clearly trended significantly lower over time. What this suggests is that the change in the total costs of large-scale solar has been a very poor predictor of the wholesale value of exported solar electricity over this time. If the ESC had adopted the approach proposed in VaDER Consultation Draft Report – adjusting the wholesale value of exported solar electricity over time by the change in the total costs of large-scale solar – its estimate of the FiT would be around one-third of its actual value.

Figure 2: ESC Fit compared with index of solar PV capital cost



Source: Frontier Economics

Given this, and given the difficulties of reasonably adjusting half-hourly prices over time without adopting the longhand method, a reasonable approach under the shorthand method is to assume that the annual value calculated using the most recent historical half hourly prices remains constant over time.

Are the recommendations provided likely to improve the ability of network businesses to identify optimal investment in DER integration?

In addition to the comments that we have made in response to the other questions, we add the following in relation to the recommendations:

- The VaDER Consultation Draft Report acknowledges that forecasting customer DER decisions is very complex, but makes no recommendation in regard to these forecasts. Our view is that the AER should establish guidelines for when such forecasting should be undertaken and should develop a framework for forecasting a change in DER that recognises that many of the drivers of DER investment are not related to the capability of the network.
- The evidence suggests that intangible benefits of DER are likely to be material. Our view is that the AER should establish a rule of thumb to account for the value of intangible benefits of DER to ensure that both the relevant costs and benefits are counted.

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