Approach to estimating the solar multiplier

As part of the 2021-22 solar feed-in tariff review, we are investigating ways to simplify our current methodology for estimating a solar multiplier. Our aim is to increase simplicity, transparency and replicability of our calculation, while maintaining a high level of accuracy.

This information paper provides our initial analysis of solar multipliers using a simpler approach. We find that the impact of using the simplified method on the "all day" feed-in tariff benchmark is negligible. For time-dependent benchmark ranges, the results vary slightly depending on the level of the variation in wholesale electricity prices during the time block. For 2020-21, the simplified method produces similar results to the Monte Carlo approach for most of the time blocks. However, between 3 and 6pm where there is high level of price variation, the simple method results higher benchmark ranges by up to 2.2 cents.

What is the solar multiplier?

In estimating the value of solar exports for the coming financial year, we forecast the average wholesale electricity spot price and then apply a 'solar multiplier'. The solar multiplier is calculated using historical data as the ratio of the solar output-weighted average electricity price to the time weighted average electricity price, where:

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

The solar multiplier captures how much solar exports occur at high or low price times. If more solar export occurs during the time when spot electricity prices are higher (lower) than average, the solar multiplier will be greater (less) than 1.

As outlined in our Issues Paper, the solar multiplier has fallen in the last three years, and the "all-day" solar multiplier is now less than 1. This means the price of electricity when solar is being exported is lower than the average wholesale price of electricity across the whole day. This is largely because more demand is being met by solar generation. Therefore, the demand for electricity from the National Electricity Market (NEM) is lower during these hours, resulting in reduced prices during these times.

What is IPART's current methodology for estimating a solar multiplier?

Since our review of solar feed-in tariffs for 2014-15, we have modelled a solar multiplier based on a Monte Carlo simulation using historical half-hourly spot prices and half-hourly solar export data. This method generates 5,000 'synthetic years' and calculates a solar multiplier for each 'synthetic year'. For the last three years, we set the solar multiplier based on the median value from the distribution of 5,000 solar multipliers. Between 2015-16 and 2017-18, we set the solar multiplier based on the 25th percentile because we considered that prices in 2009-10 and 2010-11, which were included in our dataset, were unusually high in the middle of the day compared to other years, and market evidence at the time suggested that these prices would be unlikely to reoccur.

How do we propose to simplify our current methodology?

We are considering simplifying our current methodology. A simpler method would be to calculate the solar output-weighted average price throughout a year (or multiple years) and time-weighted average price for the same period without a simulation. The key difference between this method and our current approach is that the historical solar export and price data are directly used to calculate a single solar multiplier instead of being assigned to create price and export data for 5,000 synthetic years to obtain 5,000 solar multipliers.

Table 1 explains key differences between our current methodology and the simplified approach using the solar multiplier estimation for 2018-19 as an example.

Table 1 Estimating a solar multiplier for 2020-21 using IPART's current approach and simplified approach

	IPART's current approach	Simplified approach
Key steps	*Step 1:* Construct 5,000 synthetic years through simulation and assign solar export and price from 2016-17 to 2018-19 to create each synthetic year's export and price *Step 2:* Calculate a solar multiplier for each synthetic year, resulting in a total of 5,000 solar multipliers *Step 3:* Select the median from the distribution of 5,000 solar multipliers	Calculate a single solar multiplier where solar output-weighted average price is the average price from 2016-17 to 2018-19, weighted by how much solar is exported at each half hour

Simplified approach results in similar "all day" solar multipliers and feed-in tariffs

Table 2 compares the solar multipliers using the simplified approach and Monte Carlo approach and the resulting feed-in tariff benchmarks. We have calculated the solar multipliers for the most recent three review periods (i.e., 2018-19 to 2020-21) using the same datasets. For each year, we estimated 3 solar multipliers based on the last 1 year, 2 year and 3 years' solar export and wholesale price data and then used the midpoint of the maximum and minimum solar multipliers estimated.

It shows that the simplified method results in very similar "all day" solar multipliers to the Monte Carlo approach. If we had used the simplified method over the last 3 years, it would have resulted in the same or very similar solar multipliers and feed-in tariffs. For example, for 2020-21, the simplified method would have produced a solar multiplier of 0.96, compared to 0.97. The impact of this difference on the feed-in tariff is negligible, with the difference in feed-in tariff being 0.1 c/kWh.

Table 2 "All day" solar multipliers and feed-in tariff benchmarks using Monte Carlo and simplified methods

Financial year	Solar multiplier		Feed-in tariff benchmarks	
	Monte Carlo	**Simplified**	**Monte Carlo**	**Simplified**
2018-19	0.99	0.99	6.9 to 8.4 c/kWh	6.9 to 8.4 c/kWh
2019-20	0.98	0.98	8.5 to 10.4 c/kWh	8.5 to 10.4 c/kWh
2020-21	0.97	0.96	6.0 to 7.3 c/kWh	5.9 to 7.2 c/kWh

Note: For 2019-20 and 2020-21, the solar multipliers using the simple method are the midpoint of the maximum and minimum solar multipliers estimated using the last 1 year, 2 year and 3 years' solar export and wholesale price data. For 2018-19, the solar multiplier is calculated using the last 3 years' solar export and wholesale price data.

Source: Ausgrid and AEMO.

The simple method results in different benchmarks where there is high price volatility

Retailers may offer different feed-in tariffs throughout the day to reflect the changes in wholesale electricity prices across the day. Therefore, we have been asked to set time-dependent benchmarks as a guide to the value of solar exports at different times.

Table 3 compares the 2020-21 solar multipliers and the resulting feed-in tariff benchmarks at different times of the day using the simplified approach and Monte Carlo approach. Overall, we find that our simplified method results in mostly similar solar multipliers to the Monte Carlo approach. However, when we include years where there is a high level of price volatility at particular times, the solar multipliers and the resulting feed-in tariffs using the simple method can be materially different to those using the Monte Carlo approach. For 2020-21, the simple method results in:

- 0.8 cents higher feed-in tariff benchmarks between 4 and 5pm using the last two years data
- 0.7 to 2.2 cents higher feed-in tariff benchmarks between 3 and 6pm using the last three years data.

Table 3 Time-dependent solar multipliers at different times of the day

	Approach	6AM to 3PM	3PM to 4PM	4PM to 5PM	5PM to 6PM	6PM to 7PM	7PM to 8PM
FY19	Simple	0.93	1.16	1.49	1.32	1.52	1.26
	Monte Carlo	0.93	1.16	1.48	1.32	1.50	1.28
FY18 to FY19	Simple	0.95	1.12	1.32	1.21	1.46	1.18
	Monte Carlo	0.95	1.11	1.24	1.20	1.45	1.18
FY17 to FY19	Simple	0.95	1.26	1.54	1.60	1.40	1.13
	Monte Carlo	0.95	1.16	1.48	1.27	1.40	1.14

Source: Ausgrid, AEMO and IPART analysis.

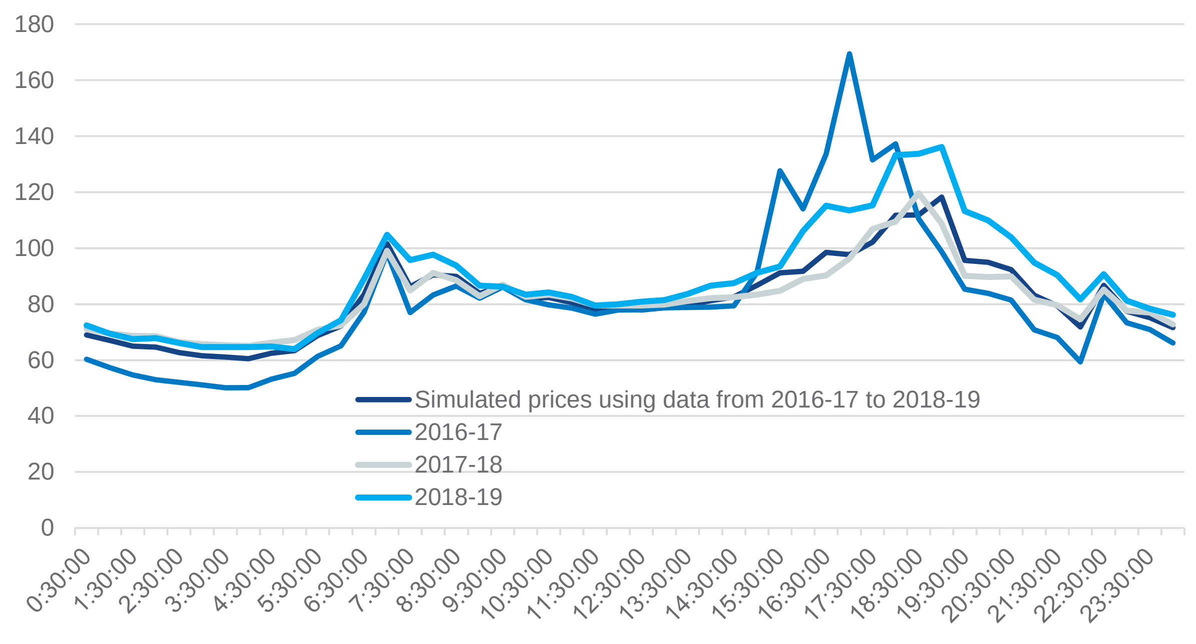
Table 4 Time-dependent feed in tariffs benchmarks at different times of the day

	Approach	6AM to 3PM	3PM to 4PM	4PM to 5PM	5PM to 6PM	6PM to 7PM	7PM to 8PM
FY19	Simple	6.3	7.9	10.1	9.0	10.3	8.6
	Monte Carlo	6.3	7.9	10.0	9.0	10.1	8.7
FY18 to FY19	Simple	6.5	7.6	9.0	8.2	9.9	8.0
	Monte Carlo	6.5	7.5	8.4	8.2	9.9	8.0
FY17 to FY19	Simple	6.4	8.5	10.4	10.8	9.5	7.7
	Monte Carlo	6.5	7.8	10.0	8.6	9.5	7.8

Source: Ausgrid, AEMO and IPART analysis.

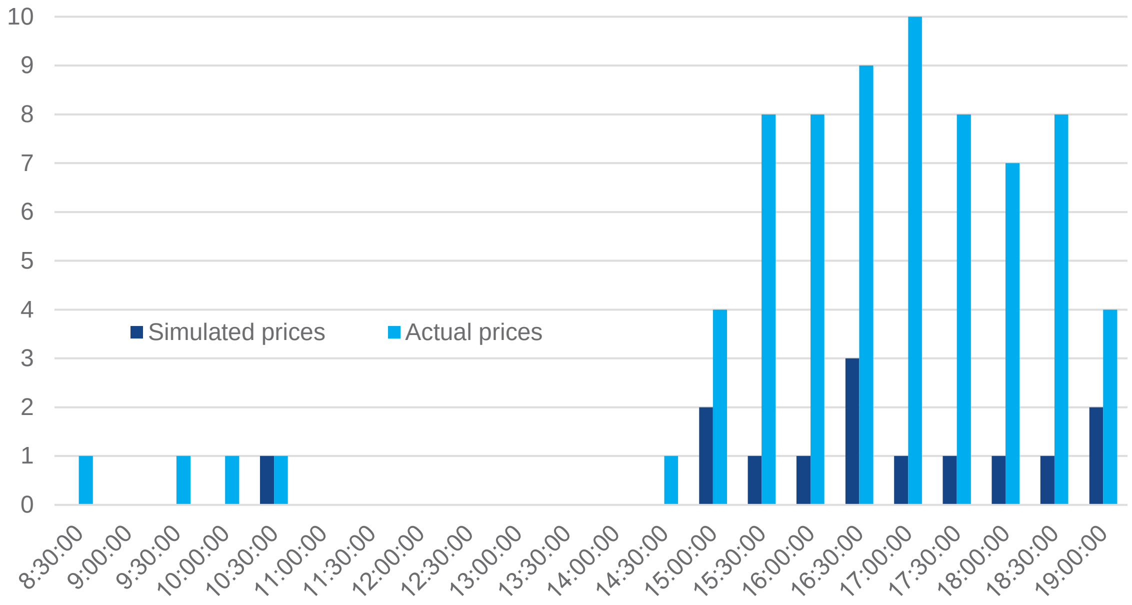
Our analysis indicates that the different results are likely due to the differences in the underlying wholesale electricity prices (Figure 1). As Figure 2 shows, there is a higher occurrence of extreme prices in the actual price data which are smoothed out in the simulated prices via randomly selecting historical prices in the Monte Carlo. Because extreme price events are significantly higher than prices at other times, they can have a material impact on the average price for the time block. This can be seen in Figure 1 between 3pm and 6pm, where the actual average prices (used in the simplified method) are higher than those generated via Monte Carlo simulation.

Figure 1 Average half hourly prices from 2016-17 to 2018-19 vs simulated prices



Data source: AEMO and IPART analysis.

Figure 2 Occurrence of prices exceeding $300/MWh from 2016-17 to 2018-19



Data source: AEMO and IPART analysis.