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REVIEW OF AER FORECAST COMPARISON

REPORT PRODUCED FOR ENERGY QUEENSLAND

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December 2019

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report has been prepared for Energy Queensland in response to the Australia Energy Regulator's (AER) draft decisions for Energex and Ergon Energy (which in turn refer to the draft decision for SA Power Networks) with respect to labour cost escalation over the next regulatory period. More specifically, it is a response to the AER's proposal to only use utilities wages' projections produced by Deloitte Access Economics (DAE), which is based on their assessment of the historical forecast performance of DAE and BIS Oxford Economics (BISOE) over the period 2007-2018.

The key conclusion from our analysis is that departing from the AER's current approach of averaging the projections produced by DAE and BISOE for growth in the all-industries and the EGWWS real WPI, by just using the DAE projections for these series, is statistically likely to result in a worse outcome (in terms of forecast accuracy) than continuing to use the current approach of averaging the two series. Moreover, for the national all-industries WPI in particular, we and the AER both find that the forecast performance of both firms has been broadly similar historically; given this, the AER's initial basis for departing from the averaging approach, that DAE's historical performance is better, is not the case.

The key implication of the potential decision to just use DAE forecasts is that this risks the AER consistently producing less accurate projections for the efficient labour costs of Energy Queensland. This could result in the firm being unable to recover the efficient costs associated with the expenditure objectives in the National Electricity Rules.

Assessment of the AER's approach

We begin with an assessment of the AER's approach to assessing the forecast performance of both firms. We note that the approach taken by the AER does not consider the following points:

- The general forecasting process undertaken by both firms. DAE and BISOE begin their projections with forecasts for the all-industries Wage Price Index. They then consider the differential between the all-industries and electricity generation, water and waste services (EGWWS) sectors. It is important to therefore consider the forecast performance with respect to the all-industries WPI and then the gap between the all-industries and the EGWWS sector to garner accurate results. If this information is not considered, the risk is that a spurious conclusion will be reached with respect to forecast performance; two offsetting forecast errors could be accidentally misconstrued as better forecast performance.

- The approach undertaken by the AER attaches an equal weight to all forecasts, irrespective of their forecast horizon. For example, they equally weight a projection for the current year with a projection for five years ahead. Given the inherent uncertainty surrounding forecasting, and the fact that this uncertainty increases with the length of forecast horizon, it is important to consider performance by forecast horizon. This is particularly true given the delay between the submission of the forecasts to the AER and the beginning of the regulatory period; if anything, the performance of both companies in the near term should carry less weight, as this period is not typically part of the regulatory period in question.
- The dataset used by the AER is asymmetric. In some cases, forecasts from the same firm are drawn from consecutive months (and we would expect these forecasts to be very similar given the timing), which will result in these particular forecasts effectively having a higher-than-average weight in the calculations of forecast performance. The overweighting of these forecasts (and implied underweighting of others) could result in biased results.

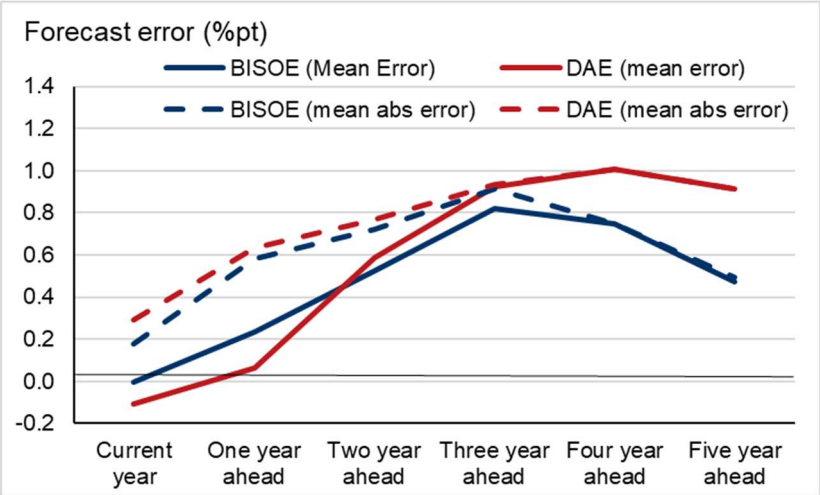
Alternative approach and results

To take account of the points noted previously we have refined the approach used by the AER to assess forecast performance. The approach uses the same metrics as the AER's exercise, namely mean deviation and mean absolute deviation in the projection for the real ex-ante WPI series. The key results are:

- For the all-industries WPI, in the near term (current year forecasts and one year ahead), the mean error in the DAE forecasts is smaller than the BISOE forecasts on average, but the mean absolute error is larger.
- In the medium/long term, the forecast performance of both firms worsens (as expected, given the increased uncertainty as the forecast horizon extends). The performance of DAE worsens more than BISOE, as measured by the mean error and the mean absolute error.

The forecast performance of the two firms with respect to the all-industries WPI is illustrated in Figure 1.

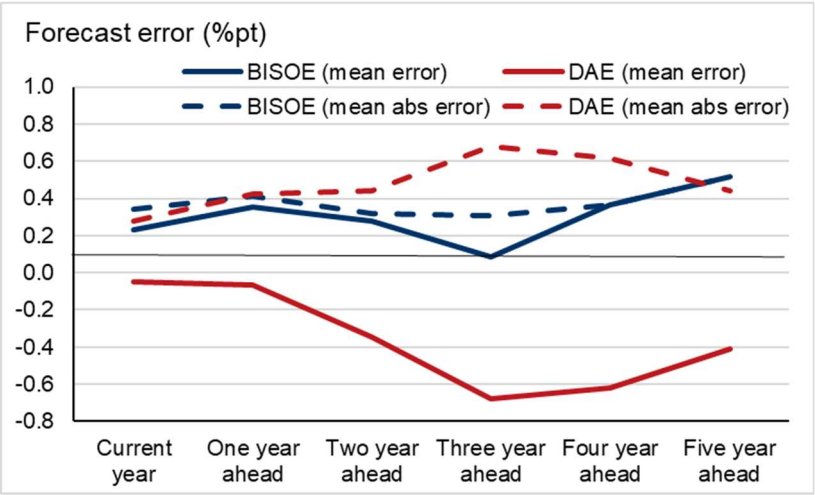
Fig. 1. BISEOE and DAE forecast performance, all-industries WPI



- For the all-industries-EGWWS gap, in the early years of the forecast horizon, the mean error of DAE's forecast is smaller than BISOE, although the mean absolute error is the same for both firms.
- In the out years (years two – five of the forecast horizon), the forecast performance of both firms worsens (again as expected). The DAE performance worsens more than BISOE, in both the mean error and the mean absolute error of the forecasts.
- Looking at the mean error and mean absolute error measures together, the BISOE forecasts exhibit some upward bias in the forecasted all-industries-EGWWS gap, particularly in the long run (years four and five). In contrast, the DAE forecasts exhibit downward bias, which is larger in size than the bias in the BISOE forecasts.

The forecast performance with respect to the all-industries-EGWWS gap is illustrated in Figure 2 below.

Fig. 2. BISOE and DAE forecast performance, all-industries-EGWWS WPI gap



Implications of using the AER approach in the future

The AER's decision to only use DAE forecasts will only result in a more accurate projection for EGWWS wages (the cited reason for the proposed change in approach) if the historical forecast performance of the last decade is repeated. That is, it will only result in a better set of predictions if the DAE upward bias in its projections for the all-industries WPI continues to be offset by its downward bias in projecting the all-industries-EGWWS gap. We do not expect this to be the case for a number of reasons:

- At the all-industries level, we note that the forecast performance of both DAE and BISOE has improved over time, with the absolute forecast errors recorded for the reports published towards the end of the review period showing smaller absolute deviations than the reports produced at the start (even when taking account of the forecast horizon). This implies that both firms have improved their approach to modelling and projecting the all-industries WPI.
- For the all industries-EGWWS gap, the general trend to overstate/understate from BISOE and DAE respectively has remained throughout the period of analysis, but it has also declined over time.

This suggests that for both firms, the biases seen in their forecasts change over time, as a result of changes (improvements) in their forecasting approach and structural shifts in the economy. Given this it should not be assumed that the forecast errors seen historically will remain the same over the forecast horizon.

We also note that in the case of the all-industries WPI, the forecast performance of DAE is not materially better than BISOE over the full forecast horizon, which implies that in the case of Energy Queensland (where the all-industries WPI is used to escalate labour costs) there is no compelling reason (based on historical forecast performance) for the AER to depart from its approach of averaging the two projections.

In addition to these points, we see a number of advantages to continuing to take an average of the two projections provided by BISOE and DAE:

- Inevitably forecasts are not 100% accurate. As the outcome is uncertain, any forecast contains some judgement as to how the economic environment is going to evolve over time. An individual forecaster is very unlikely to outperform their peers for all series at every point in time over the forecast horizon (as is highlighted in the forecast assessment we have just presented), as a number of unforeseeable developments influence the outcome for any given series.
- Therefore having access to and using more than one set of projections (via a numerical average or other statistical technique) in a determination will reduce the risk of errors in a particular approach to forecasting or view of the economic outlook (either positive or negative) unduly influencing the proposed profile for escalating wages.

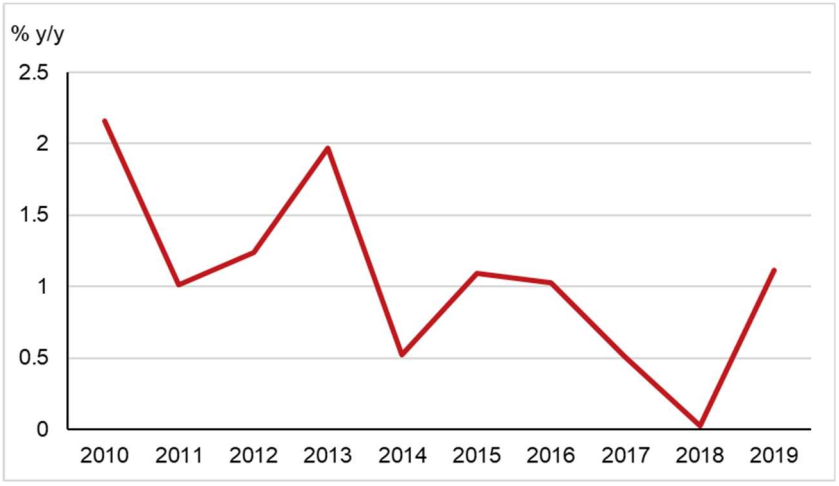
Given these observations, the AER's current approach of averaging the projections from DAE and BISOE is statistically likely to produce the most accurate projections for wage increases over the forward-looking horizon.

Assessment of the latest data and outlook

As noted in the AER's draft determination for SA Power Networks, nominal wage growth across the economy as a whole is subdued at the moment, relative to its historical performance. But this outcome partly reflects (and is to some extent a cause of) the current low inflation environment. In real terms, the all-industries national WPI (excluding bonuses) grew by 0.6% y/y and the EGWWS WPI by 1.1% y/y, broadly the same as their average pace over the last decade.

For the EGWWS sector, FY19 saw a rebound in real wage growth, as the drag on the national index from the structural reforms that took place in NSW in 2016-18 abated (see Figure 3).

Fig. 3. Real EGWWS WPI



Looking ahead, in line with the views of a number of stakeholders, in our view the immediate outlook for wages growth across the economy is subdued; in our October 2018 report, we expected the real EGWWS WPI to increase 0.8% y/y in FY19 and 0.9% y/y in FY20 (slightly below the pace recorded in the latest data for the September quarter 2019), and for the real all-industries WPI to increase by 0.5% in FY19 and 0.4% in FY20 (in line with the September quarter 2019 pace of 0.5%). Together with the subdued pace of price inflation, this will result in nominal wages growth well below the long run average.

But moving into the early 2020s, we expect the headwinds currently facing the economy to abate; the residential construction downturn will have come to an end, public sector infrastructure spending will be trending up, and mining sector capital expenditure will be rising rapidly[1]. Using historical performance as a reference point, this upswing in activity is expected to drive a pick-up in real utilities wages growth (as was seen during the mining investment boom in the early 2010s), as a result of competition from the construction sector for skilled labour. Growth in the all-industries WPI is also expected to pick-up, but to a lesser extent.

[1] Given the lead times between projects being announced, confirmed as funded and getting underway, we have clear sight that an upturn in public infrastructure and mining investment will begin in late 2020, with growth momentum expected to peak in FY23.

1. INTRODUCTION

This report presents the results of our critical analysis of the AER approach to assessing the forecast accuracy of DAE and BISOE with respect to ex-ante real EGWWS wages, as captured by the WPI, and the potential flaw in their decision to only use DAE projections as the basis for allowable increases in efficient labour costs over the next regulatory period.

We begin with a critical assessment of the AER's approach to assessing the forecast performance of the two firms, highlighting deficiencies in the approach. We then present the results from our nominated approach to assessing the projections. Finally, we provide an assessment of the implications of adopting the AER's proposal to only use DAE projections going forward, and we suggest an alternative that should be expected to produce more accurate forecasts for wages growth in the utilities sector.

2. ASSESSMENT OF AER COMPARISON EXERCISE

2.1 AUSTRALIAN ENERGY REGULATOR APPROACH

As part of their draft decisions for Energex and Ergon Energy's next regulatory period, the AER referred to the SA Power Networks (SAPN) draft decision, where they conducted an assessment of the historical forecasts produced by Deloitte Access Economics (DAE) and BIS Oxford Economics (BISOE). This exercise used data from 18 DAE and 16 BISOE reports from the years 2007 – 2018, and focused on the Australia electricity, gas, water and waste services (EGWWS) Wage Price Index (WPI) reported by the Australia Bureau of Statistics.

The AER focused on the two companies' forecast performance in projecting the real (ex-ante) EGWWS WPI for each year of their sample period. They concluded that in the years 2007-2011, the forecast performance of the firms was similar, and this formed the basis of their decision to take an average of the two projections in previous decisions. For the period 2012-2018, they concluded that DAE produced materially more accurate forecasts.

The quantitative approach used to assess the forecast performance of the two firms was to calculate the difference between forecasted and reported real growth in the Australia EGWWS WPI. A range of forecast projections were used, drawn from reports submitted to the AER by both firms. As the approach was done on a year-by-year basis, the projections for wage growth in any given year were drawn from different forecast horizons. For example, the set of projections for FY18 were taken from reports published between late 2013 (when FY18 was the last year of the forecast horizon) through to early 2018 (when FY18 was the current year of the forecast horizon).

Each projection was then compared with the actual outturn for growth in the real EGWWS WPI, and the difference between the two was calculated. The forecast errors were then averaged, to calculate the mean error. The AER also calculated the mean absolute error, to remove the possibility that positive and negative errors were cancelling each other out.

The conclusion of the AER from conducting this exercise was (quotes taken from the SAPN draft decision): "Over the period from 2007 to 2018, Deloitte's real WPI growth forecasts had a mean error of 0.1, compared to BIS Oxford Economics mean error of 0.7" and "We also looked at the mean absolute errors. We found Deloitte had a lower mean absolute error of 0.5 percentage points, compared to 0.8 percentage points for BIS Oxford Economics. This shows that Deloitte's forecasts also tend to be closer to actual real WPI growth than BIS Oxford Economics'."

Based on their analysis, the AER now considers that the DAE forecasts for EGWWS WPI growth "better reflects actual Australian utilities real WPI growth." The decision also notes that they were not able to conduct this analysis on South Australian EGWWS wages, as the ABS does not publish this index. Given this, they consider the forecasting performance of DAE and BISOE at

the national level as indicative of the performance for South Australia. In the Energex and Ergon Energy draft decisions, there is no reference made to the forecast performance of DAE and BISOE with respect to the EGWWS WPI or the all-industries WPI. We are therefore assuming that they are using the forecast performance of the two firms for the national EGWWS WPI as a proxy for their performance projecting WPIs for Queensland.

We also note that the underlying data series produced by the ABS, the WPI series, are themselves estimates of movements in labour costs produced by the ABS (rather than being *actual* labour costs for a specific firm/organisation). The WPI series are drawn from firm surveys and are designed to specifically capture changes over time in the cost of labour faced by firms. As such, the ABS consciously excludes the impact of changes in the composition of the work force, the number of hours worked, and characteristics of employees (i.e. productivity) from the index. As all of these factors (as well as economic conditions) determine actual labour costs for any given organisation, the forecasts for the WPI series used by Energy Queensland in its submission and the AER in its decisions are only ever approximations of actual costs.

2.2 KEY OMISSIONS IN APPROACH

In analyzing the approach and results of the AER's forecast assessment exercise, we have identified two deficiencies in the approach, one major and one minor. In the following section we outline each.

2.2.1 Consideration of forecasting methodology

By only using the forecast performance for the EGWWS WPI as a determinant of performance, the AER is ignoring crucial information about how both DAE and BISOE conceptually construct their projections. Both firms use the same broad approach, which is to consider the outlook for the all-industries WPI, and to then consider the differential between this and the EGWWS sector[2]. It is important to therefore consider the forecast performance with respect to the all-industries WPI and then the gap between the all-industries and the EGWWS sector to garner accurate results. If this information is not considered, the risk is that a spurious conclusion will be reached with respect to forecast performance; two offsetting forecast errors could be accidentally misconstrued as better forecast performance.

DAE's approach to projecting the difference between the EGWWS sector and the all-industries WPI models the gap as a function of:

- a **cyclical component**, which is based on the relative performance of the sector (in output terms) compared to the national average;
- **competition** (relative wage) factors, based on wage movements in sectors that would be competing with the sector, because of readily transferable skills. For utilities, this would be mainly relative wage movements in the construction, mining and manufacturing sectors.

[2] DAE provide details of their approach in the report 'Labour Price Growth Forecasts' prepared for the Australian Energy Regulator, published 19th July 2018.

DAE supplement their formal model with judgements to incorporate data volatility and developments in Enterprise Bargaining Agreements (EBAs). They report that these judgements are applied to their short term projections.

BISOE's approach to modelling the gap takes account of structural features within the EGWWS sector, in particular the relatively high level of unionization in the sector. Unlike DAE, we assume that the impact of unionization, which manifests itself in the EBAs that are reached between unions and the utilities companies, persists over the full forecast horizon.

Given the forecasting approach taken by both firms, any assessment of forecast performance should consider performance at each stage of the process, to assess the size and direction of any biases that are introduced through the projections.

2.2.2 Consideration of forecast horizon and asymmetry of data set

The AER's approach aggregated all of the forecasts for the EGWWS WPI together, with each individual projection treated equally in the calculation of the mean error and mean absolute error. This approach ignores two related characteristics of the forecasts:

- The accuracy of any forecast decreases over the forecast horizon. For example, all forecasts for the current year will be more accurate than forecasts for three years ahead, as high frequency data is available, current trends are directly observable etc. Given this, any assessment of forecast accuracy needs to take account of when the forecast for a particular year was made and apply the assessment on the basis of forecast horizon.
- The AER uses a comprehensive set of forecasts produced by DAE and BISOE, drawing the forecasts from 18 DAE reports and 16 BISOE reports. The data they use is included in the appendix of the SAPN draft decision, but in reviewing the data we note that the distribution of the reports over time from the two firms is uneven. In some years, forecasts from the same firm are drawn from consecutive months (and we would expect these forecasts to be very similar given the timing), which will result in these particular forecasts effectively having a higher-than-average weight in the calculations of forecast performance. The overweighting of these forecasts (and implied underweighting of others) could result in biased results.

In the next chapter we will address the points raised above to produce an alternative assessment of the forecast performance of both firms.

3. ALTERNATIVE FORECAST PERFORMANCE ASSESSMENT

3.1 REPLICATING THE AER'S APPROACH

Before we present the results of our suggested approach to assessing forecast performance, we have replicated the AER's approach, namely assessing the forecast performance of the two firms with respect to the real EGWWS WPI, but with the issues of forecast horizon and sample bias highlighted in Section 2.2.2 addressed.

Fig. 4. Forecast performance using AER approach

	Mean error		Mean absolute error	
	BISOE	DAE	BISOE	DAE
Current year	0.2	-0.2	0.4	0.3
One year ahead	0.6	0.0	0.7	0.8
Two year ahead	0.8	0.2	0.9	0.6
Three year ahead	0.9	0.2	1.0	0.7
Four year ahead	1.1	0.4	1.1	0.5
Five year ahead	1.0	0.5	1.0	0.6

Approaching the assessment in this way does not change the general result of the analysis, with the mean error and mean absolute error for DAE lower on average than BISOE; our cleaning of the data set to remove duplicate forecasts and rebalance the panel over time have not changed the general result[3]. But it does highlight that the forecast performance (with respect to the real EGWWS WPI) of the two firms is similar for the first two years of the forecast horizon, with the differential between the two firms increasing over time.

In line with the AER approach, we only examined forecasts up to five years ahead. Additional years suffer from a reduced sample size (by definition, any forecasts produced after FY14 will not have six or more years of actual data to compare to), and our preliminary assessment of the limited sample we do have suggests that the conclusions would be unchanged.

3.2 RESULTS OF OUR NOMINATED APPROACH

Our nominated approach to assessing the forecast performance of the two firms breaks the forecasts down into projections for the all-industries WPI (stage one) and the differential between the all-industries and the EGWWS WPI (stage two). As previously noted, given the forecast approach of both BISOE and DAE (which is to consider the outlook for all-industries first, and

[3] Appendix A includes the dataset we have used in our analysis. We note that it was not possible to completely rebalance the panel, and consider pairs of projections from the two firms that were produced at the same point in time; from reviewing the available data, there are only five pairs, where the projections from both firms were reported to the AER within one month of one another, and we consider this sample size to be too small for any firm conclusions to be drawn.

then the differential between the all-industries and EGWWS), it is important to consider forecast performance at both stages. By only looking at the final outcome (real EGWWS), the risk is that a spurious conclusion will be reached with respect to forecast performance; two offsetting forecast errors could be accidentally misconstrued as better forecast performance.

In line with the AER, we consider the forecast performance for real wages/the differential in real wages, removing the ex-ante projection for CPI inflation produced at the time of the forecast.

3.2.1 Stage one forecast assessment

Fig. 5. Forecast deviations in real all-industries WPI

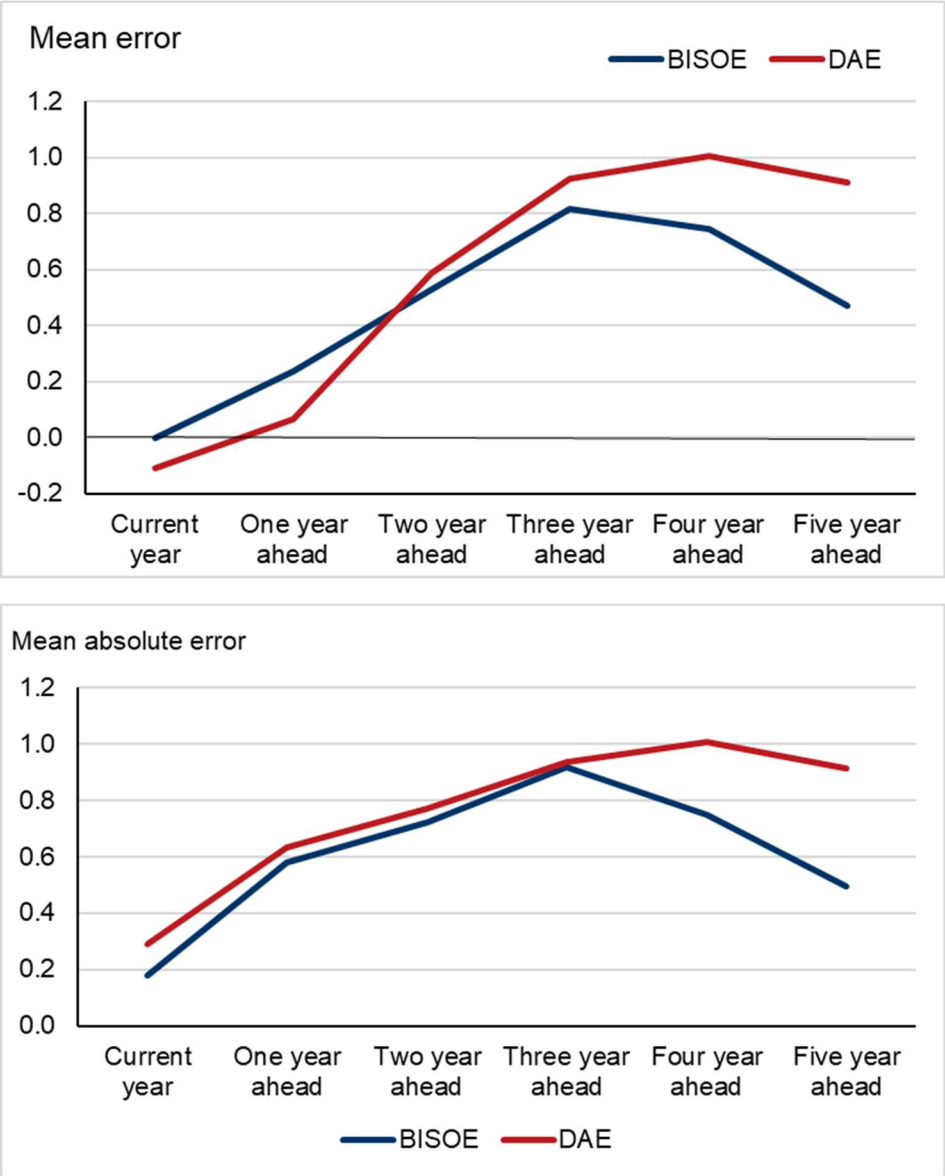
	Mean error		Mean absolute error		Skewness	
	BISOE	DAE	BISOE	DAE	BISOE	DAE
Current year	0.0	-0.1	0.2	0.3	-0.2	-1.8
One year ahead	0.2	0.1	0.6	0.6	0.8	1.2
Two year ahead	0.5	0.6	0.7	0.8	0.3	1.8
Three year ahead	0.8	0.9	0.9	0.9	-1.9	0.8
Four year ahead	0.7	1.0	0.7	1.0	0.9	0.2
Five year ahead	0.5	0.9	0.5	0.9	1.8	0.9

Figures 5 and 6 presents the results from stage one of our analysis. As the AER note, the forecast performance of the two companies when looking at the all-industries WPI is similar, but we note the following differences:

- In the near term (current year forecasts and one year ahead), the mean error in the DAE forecasts is smaller on average, but the mean absolute error is larger.
- In the medium/long term, the forecast performance of both firms worsens (as expected). The performance of DAE worsens more than BISOE, as measured by the mean error and the mean absolute error (see Figure 5) used by the AER.
- When looking at the distribution of the forecast errors, as measured by their skewness[4], we note that both firms produced forecasts that were subject to skew. The degree of skew varies over time and in direction. In general, over the medium-term horizon both firms saw positive skew in their projections, implying that (to varying degrees), the forecast errors were typically above the mean value.

[4] A skewness value of zero would imply perfectly symmetrical values around the mean forecast error, implying that the mean of the distribution is equal to the median. A positive value implies skewness to the right (that is, above the mean value) and a negative value implies skewness to the left (that is, below the mean value). The absolute size of the skewness coefficient gives an indication of the degree of skew, with a larger value implying a higher degree.

Fig. 6. All-industries forecast deviations by forecast horizon



In general, we conclude that BISOE's forecast performance is moderately better when the forecast horizon is taken into account.

Assessing the forecast performance of the average forecast

Given the AER's approach until the current draft decisions, of using the average projection from DAE and BISOE as the escalator for real labour costs, we have also assessed the performance of a hypothetical average forecast[5]. A simple assessment of the performance of an average forecast would be to

[5] This exercise was done by averaging the forecast errors from the two sets of projections at each forecast horizon. We note that this is a valid approach as the number of forecasts from each firm in our dataset is the same (11 sets of projections).

average the forecast errors presented in Figure 5. The results of this (when looking at mean error) are as follows:

- The average outperforms the others in the current year
- DAE outperforms one year ahead
- BISOE outperforms two years, three years, four years and five years ahead

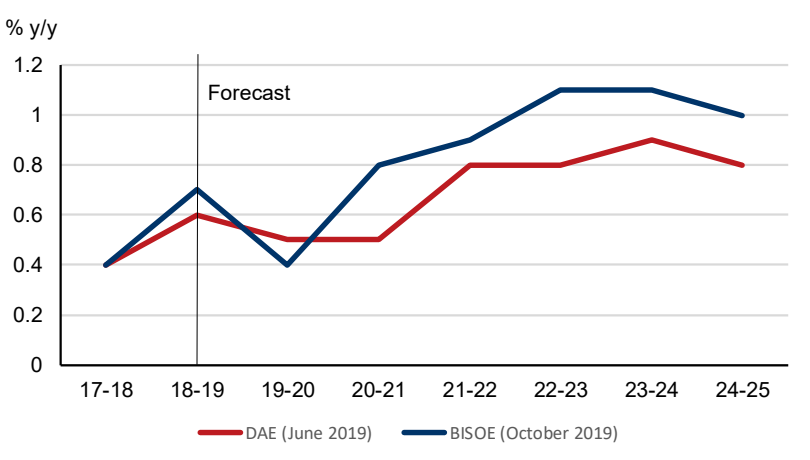
It should be noted that in the one-year to five-year ahead projections, the average always performs second-best, given the positive reported forecast error for both firms.

Forecast performance for Queensland all-industries WPI

As was noted in the SAPN draft decision, the ABS does not publish WPI series for the EGWWS sector at the state level, with the exception of NSW and VIC. To assess the forecast performance of BISOE and DAE with respect to Queensland, we must therefore focus on the all-industries WPI.

In addition to this, we have a very limited sample of forecasts with which to assess forecast performance, particularly for BISOE (the Queensland all-industries WPI is not part of our core forecast database). As a result, it is not possible for us to accurately assess the relative forecast performance of the two firms. Instead, we can compare the latest forecasts produced by the two firms, to identify whether there are systemic differences.

Fig. 1. Projections for Queensland real all-industries WPI



As can be seen, in the near term the projections are very similar, and it is only over the medium term that the gap widens, with BISOE expecting stronger growth than DAE. This is consistent with the BISOE view that Queensland's economy will accelerate in the medium term, to outstrip growth elsewhere, as private and public investment sees a pick-up following its current slump.

3.2.2 Stage two forecast assessment

We now present the results from the second stage of our analysis, which looks at the differential between (real) all-industries and EGWWS wages growth.

Fig. 7. Forecast deviation in all-industries-EGWWS differential

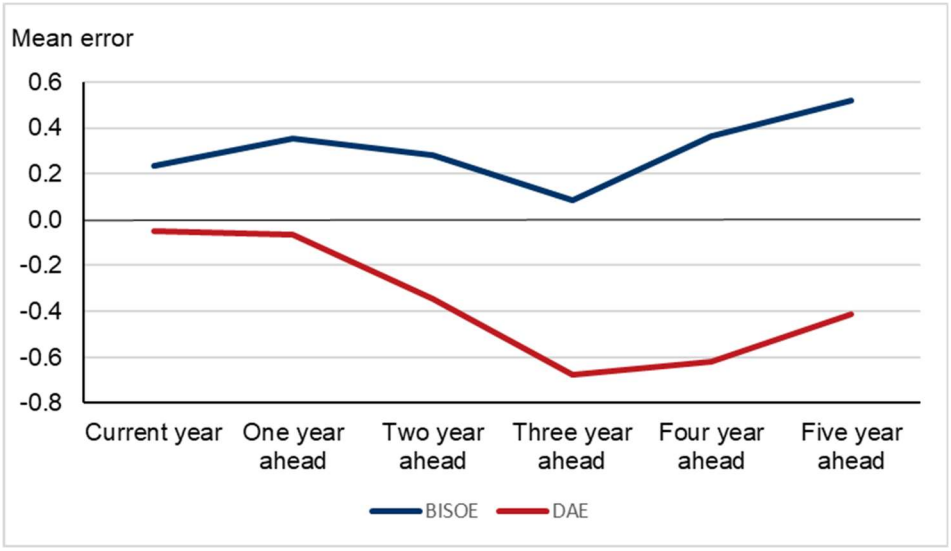
	Mean error		Mean absolute error		Skewness	
	BISOE	DAE	BISOE	DAE	BISOE	DAE
Current year	0.2	0.0	0.3	0.3	-1.2	-0.6
One year ahead	0.4	-0.1	0.4	0.4	1.0	0.7
Two year ahead	0.3	-0.3	0.3	0.4	1.2	0.4
Three year ahead	0.1	-0.7	0.3	0.7	-1.4	-1.3
Four year ahead	0.4	-0.6	0.4	0.6	-0.4	2.0
Five year ahead	0.5	-0.4	0.5	0.4	0.9	2.1

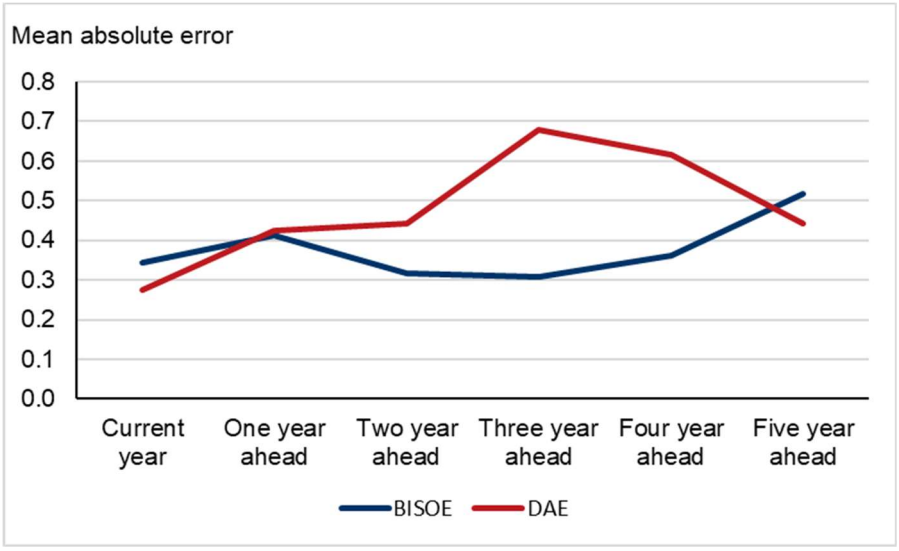
As was found in the first stage of the analysis, the forecast performance of both firms worsens as the forecast horizon increases, as expected. We note the following specific observations:

- In the early years, the mean error of DAE's forecast is smaller than BISOE, although the mean absolute error is the same.
- In the out years (years two – five), the forecast performance of DAE worsens more than BISOE, in both the mean error and the mean absolute error.
- Looking at the mean absolute error measure, the BISOE forecasts exhibit some upward bias in the forecasted all-industries-EGWWS gap, particularly in the long run (years four and five); in these later years the bias is always positive. In contrast, the DAE forecasts exhibit downward bias; all of the projections for three years, four years and five years ahead reported a negative forecast error within the sample.
- As in the case of the all-industries projections, the EGWWS-gap projections all exhibit some degree of skewness. The shape of the skew (positive or negative) varies for both firms over the forecast horizon.

These points can be seen in Figure 8 below.

Fig. 8. All-industries-EGWWS forecast deviations by forecast horizon





Overall, our analysis suggests that at the all-industries level the forecast performance of BISOE and DAE is similar. When looking at the all-industries-EGWWS differential, BISOE has outperformed DAE, particularly over the medium and long-term forecast horizon. This conclusion can be reconciled with the result of the AER's comparison exercise by noting the following:

- On average, both firms exhibit positive bias in their projections for the all-industries WPI.
- On average, BISOE exhibited positive bias in their projections for the all-industries-EGWWS gap, while DAE exhibited negative bias in their projections. We note that the absolute size of the error in the DAE projections is larger than the absolute error in the BISOE projections.

Assessing the forecast performance of the average forecast

As in the case of the all-industries WPI, we can also assess the forecast performance of an average projection, by taking the average deviation from the two firms at each forecast horizon. The average forecast performance is materially better than either firm individually (see Figure 9), with the exception

of the three year ahead projections, where BISOE outperforms. This is because the tendency to understate the EGWWS gap from DAE is offset against the tendency to overstate the EGWWS gap by BISOE

Fig. 9. Mean forecast error comparison

Mean error			
	BISOE	DAE	Average
Current year	0.2	0.0	0.1
One year ahead	0.4	-0.1	0.1
Two year ahead	0.3	-0.3	0.0
Three year ahead	0.1	-0.7	-0.3
Four year ahead	0.4	-0.6	-0.1
Five year ahead	0.5	-0.4	0.1

3.2.3 Overall forecast performance

Overall, the positive error in the DAE forecasts for the all-industries WPI is being combined with the negative error in projecting the EGWWS differential, while BISOE is compounding a positive error in the all-industries projection with a positive error in the EGWWS differential. This results in an apparently better forecast performance for the EGWWS WPI, but this is a result of a positive error and a negative error offsetting one another. In absolute terms, the sum of the errors across the two stages is higher for DAE than BISOE, particularly in the later years of the forecast horizon.

Given the relatively similar forecast performance of DAE and BISOE with respect to the all-industries WPI, the outperformance of DAE with respect to the EGWWS will only continue if they continue to underestimate the differential between the all-industries WPI and the EGWWS WPI.

Fig. 10. Cumulative forecast error

	Mean error		Mean absolute error	
	BISOE	DAE	BISOE	DAE
Current year	0.2	-0.2	0.5	0.6
One year ahead	0.6	0.0	1.0	1.1
Two year ahead	0.8	0.2	1.0	1.2
Three year ahead	0.9	0.2	1.2	1.6
Four year ahead	1.1	0.4	1.1	1.6
Five year ahead	1.0	0.5	1.0	1.4

3.2.4 Assessment of DAE and BISOE approach to forecasting EGWWS wages

As noted previously, the approach used by DAE is to link deviations in the pace of growth from the all-industries aggregate to business cycle factors and competition factors. The business cycle factors use the relative growth rate of the industry (compared to the national average and compared to history) as a measure of the cyclical position of the sector. As a relatively slow-growing sector (when compared to the national average), this implies that within the

DAE model, utilities wages would be expected to underperform when compared to average across all sectors.

The actual outturn for the all-industries-EGWWS differential has been positive and averaged 0.4%pts for the period 2007-2018 (financial year basis). This suggests that the model used by DAE to project this differential is potentially mis-specified. As outlined above, based on the description of the model used by DAE, this is likely to be a result of the relative pace of growth of the utilities sector compared to the national average. In addition, we also note that DAE assume that non-model drivers such as EBAs are only adjusted for in the short term, implicitly implying that they do not have an impact on the long-term profile for wages growth.

In contrast to DAE, we see the relatively high unionisation rates (61% of utilities' employees are covered by a collective agreement, compared to 37% across the economy as a whole) as a structural feature of the utilities sector. Furthermore, we see this structural feature as having a material impact on the pace of wages growth in the short and long run; our analysis suggests that it largely explains the outperformance of the EGWWS WPI (relative to the all-industries) over the historical period.

In contrast to DAE, the BISOE projections have typically overestimated the differential between the all-industries and EGWWS WPI. This suggests that the BISOE modelling approach overstates the importance of structural factors such as the relatively high rate of unionisation, in driving wage growth in the utilities sector. Conversely the BISOE implicitly understates the importance of short run, cyclical factors in determining EGWWS wages. In particular, we note that we underestimated the impact of the structural reforms that took place in the NSW utilities sector in the period FY16-FY18, which resulted in an exceptionally low pace of growth in the EGWWS WPI (both in the NSW series and in the national series).

4. IMPLICATIONS OF AER'S PROPOSED APPROACH

The AER have proposed a new approach to determining labour cost escalation factors, which only uses the projections produced by DAE. This decision is based on their conclusion that DAE's historical forecast performance is better than BISOE. As outlined in Chapter 3, our analysis has identified that this conclusion is spurious, and a result of a positive forecast error in the first stage of the forecasting process being offset by a negative error in the second stage; in absolute terms, DAE's forecast performance is worse than BISOE, particularly in the medium and long-term.

Looking ahead to projections for future wages growth in the utilities sector, the AER's decision to only use DAE forecasts will only result in a more accurate projection for EGWWS wages (the cited reason for the proposed change in approach) if the historical forecast performance of the last decade is repeated. That is, it will only result in a better set of predictions if the DAE upward bias in its projections for the all-industries WPI continues to be offset by its downward bias in projecting the all-industries-EGWWS gap. We do not expect this to be the case for a number of reasons:

- At the all-industries level, we note that the forecast performance of both DAE and BISOE has improved over time, with the absolute forecast errors recorded for the reports published towards the end of the review period showing smaller absolute deviations than the reports produced at the start (even when taking account of the forecast horizon). This implies that both firms have improved their approach to modelling and projecting the all-industries WPI.
- For the all industries-EGWWS gap, the general trend to overstate/understate from BISOE and DAE respectively has remained throughout the period of analysis, but it has also declined over time.

This suggests that for both firms, the biases seen in their forecasts change over time, as a result of changes (improvements) in their forecasting approach and structural shifts in the economy. Given this it should not be assumed that the biases seen historically will remain the same over the forecast horizon.

We also note that in the case of the all-industries WPI, the forecast performance of DAE is not materially better than BISOE over the full forecast horizon, which implies that in the case of Energy Queensland (where the all-industries WPI is used to escalate labour costs) there is no compelling reason (based on historical forecast performance) for the AER to depart from its approach of averaging the two projections.

More broadly, it should be noted that inevitably forecasts are not 100% accurate, as a number of unforeseeable developments influence the outcome for any given series. It is also the case that the quality of projections generally improves over time, as methodologies are refined and improved. Finally, having access to and using more than one set of projections (via a numerical average or other statistical technique) in a determination will reduce the risk of

errors in a particular approach to forecasting (either positive or negative) unduly influencing the proposed profile for escalating wages.

From the analysis presented previously, this is particularly true of the forecasts for the all industries-EGWWS gap, which forms one part of the overall projection for EGWWS WPI for both DAE and BISOE. The mean forecast error at every time horizon apart from three years ahead[6] across DAE and BISOE projections was materially smaller than the error produced by either individual firm. We can infer from this that at any given point in time when the AER is considering forecasts for the EGWWS WPI produced by BISOE and DAE, given the projection for the all-industries WPI, the average of the increment projected from the two firms is statistically likely to be a more accurate projection of the profile for the national EGWWS WPI (when compared to a single projection from either individual firm).

Given these observations, the AER's current approach of averaging the projections from DAE and BISOE is statistically likely to produce the most accurate projections for EGWWS wages over the forward-looking horizon.

[6] For this time horizon, the BISOE projections outperformed the average of the BISOE and DAE projections, as measured by the mean forecast error.

APPENDIX A – DATASET

All-industries real ex ante WPI													
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Actual		**0.9**	**1.0**	**0.8**	**1.0**	**0.8**	**0.7**	**1.3**	**1.0**	**-0.1**	**0.7**	**0.7**	**0.2**	**0.1**
BISOE	March 2007	0.9	1.1	1.5	0.9	1.4	1.3	1.3	1.2	-	-	-	-	-
DAE	April 2007	-	-0.3	2.6	4	1.8	1.6	2.9	3	2.4	1.8	2	-	-
DAE	March 2010	-	-	-	-	1.1	0.8	0.9	1	1.6	1.7	1.3	1.2	1.5
BISOE	July 2010	-	1	0.7	1	0.7	0.3	0.8	0.7	1.2	0.9	1	-	-
BISOE	November 2010	-	-	-	-	0.8	1	0.8	0.9	1.2	1.1	1	1.1	-
DAE	December 2010	-	-	-	-	-	0.7	0.9	1.7	2.3	2.1	1.2	1.2	1.5
DAE	March 2012	-	-	-	-	-	-	1	0.7	1.1	1.8	1.1	0.9	1.3
BISOE	April 2012	-	-	-	-	0.8	0.7	1.1	1.2	1.7	1.8	1.2	1.7	2.1
DAE	October 2012	-	-	-	-	-	-	-	1.4	1.2	0.9	0.9	0.9	1
BISOE	November 2012	-	-	-	-	-	-	1.2	1.2	1.6	1.8	1.6	1.2	-
DAE	July 2014	-	-	-	-	-	-	-	1	-0.1	0.3	0.5	0.8	1.4
BISOE	December 2014	-	-	-	-	-	0.7	1.3	1	-0.1	0.6	0.3	0.9	1.2
DAE	February 2015	-	-	-	-	-	-	-	-	-0.1	0.7	-0.2	0	0.8
BISOE	May 2015	-	-	-	-	-	-	-	-	-	0.9	0.4	0.6	1.2
DAE	June 2015	-	-	-	-	-	-	-	-	-0.1	0.8	0.4	0.1	0.9
BISOE	July 2015	-	-	-	-	-	-	-	-	-	0.6	0.4	0.7	1.2
DAE	February 2016	-	-	-	-	-	-	-	-	-	-	0.7	-0.3	0.6
BISOE	October 2016	-	-	-	-	-	-	-	-	-	-	-	0.2	0.7
DAE	February 2017	-	-	-	-	-	-	-	-	-	-	-	0.1	0.4
BISOE	February 2017	-	-	-	-	-	-	-	-	-	-	-	0.4	0.6
BISOE	October 2017	-	-	-	-	-	-	-	-	-	-	-	-	-0.1
DAE	February 2018	-	-	-	-	-	-	-	-	-	-	-	-	0.3

EGWWS real ex ante WPI														
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Actual		**2.0**	**1.8**	**0.8**	**1.4**	**2.0**	**1.1**	**1.2**	**1.9**	**0.5**	**1.1**	**1.0**	**0.5**	**0.0**
BISOE	March 2007	2.3	2.7	2.8	1.9	1.9	1.7	1.9	1.6	-	-	-	-	-
DAE	April 2007	-	1.2	3.7	4.7	1.4	1.2	2.3	2.3	2	1.1	1.3	-	-
DAE	March 2010	-	-	-	-	1.9	1	0.9	1	1.5	1.6	1.3	1.3	1.6
BISOE	July 2010	-	2.1	0.7	1.4	2	1.1	1.7	1.6	1.9	1.9	1.6	-	-
BISOE	November 2010	-	-	-	-	2.1	1.8	1.7	1.7	1.9	2.2	1.7	1.7	-
DAE	December 2010	-	-	-	-	-	0.9	1.4	1.8	2.2	1.9	0.9	1	1.3
DAE	March 2012	-	-	-	-	-	-	0.9	0.7	0.9	1.4	0.7	0.6	1.1
BISOE	April 2012	-	-	-	-	2.1	1.2	1.5	1.9	2.4	2.4	2.1	2.3	2.6
DAE	October 2012	-	-	-	-	-	-	-	1.4	1.2	0.9	0.9	0.9	1
BISOE	November 2012	-	-	-	-	-	-	1.2	1.5	2.2	2.6	2.5	1.9	-
DAE	July 2014	-	-	-	-	-	-	-	1.9	0.7	0.7	0.4	0.4	0.9
BISOE	December 2014	-	-	-	-	-	1.1	1.2	1.9	0.6	1.2	0.7	1.1	1.4
DAE	February 2015	-	-	-	-	-	-	-	-	0.5	1.4	0.1	0.2	0.5
BISOE	May 2015	-	-	-	-	-	-	-	-	-	1.5	0.9	0.9	1.4
DAE	June 2015	-	-	-	-	-	-	-	-	0.5	1.3	0.6	0	0.5
BISOE	July 2015	-	-	-	-	-	-	-	-	-	1.2	0.8	0.9	1.4
DAE	February 2016	-	-	-	-	-	-	-	-	-	-	0.8	-0.3	0.1
BISOE	October 2016	-	-	-	-	-	-	-	-	-	-	-	0.8	1
DAE	February 2017	-	-	-	-	-	-	-	-	-	-	-	0.5	0.4
BISOE	February 2017	-	-	-	-	-	-	-	-	-	-	-	0.9	0.9
BISOE	October 2017	-	-	-	-	-	-	-	-	-	-	-	-	0.2
DAE	February 2018	-	-	-	-	-	-	-	-	-	-	-	-	0.3

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