Jemena Gas Networks (NSW) Ltd

Revised 2020-25 Access Arrangement Proposal

Attachment 5.5

Response to the AER's draft decision - Review of AER wage forecast comparison

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BIS OXFORD ECONOMICS

REVIEW OF AER WAGE FORECAST COMPARISON

REPORT PRODUCED FOR JEMENA GAS NETWORKS

DECEMBER 2019

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December 2019

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EXECUTIVE SUMMARY

This report has been prepared for Jemena Gas Networks, in response to the Australia Energy Regulator's (AER) draft decision with respect to labour cost escalation over the next regulatory period. 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, and particularly the period 2012-18.

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 only use DAE forecasts is that this risks the AER consistently producing less accurate projections for the efficient labour costs of Jemena Gas Networks. This could result in the firm being unable to recover the efficient costs associated with the expenditure objectives as set under the National Gas 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 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, with this delay usually at least one year (and as much as two years). i.e typically, both DAE and BISOE provide forecasts for 6 or 7 years, with the first 1 to 2 years actually not part of the next regulatory period for which the forecasts are provided. Therefore, the **near-term performance** of both companies **should carry less weight**, as this period is typically not 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.

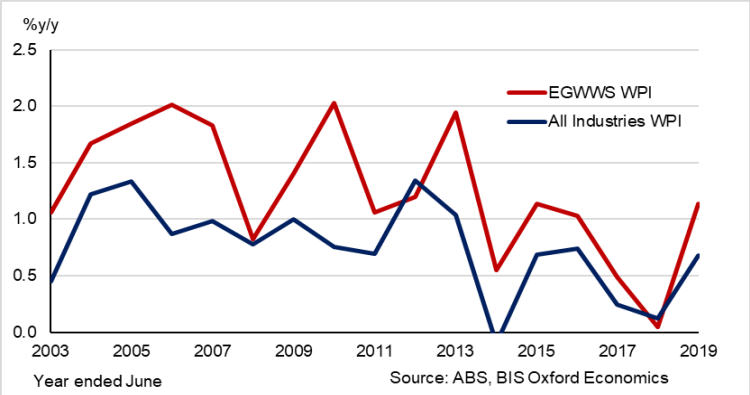
- The general forecasting process undertaken by both firms. DAE and BISOE **begin their projections with forecasts for the all-industries Wage Price Index**. They **then consider the differential** (gap) between the all-industries and electricity, gas, water and waste services (EGWWS) sectors. It is 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 a better forecast performance.**

With respect to the last point, our assessment is that is **exactly what happened**. Most of the medium-term forecasters (including the Federal Treasury) over-estimated the all-industries wages growth over the past five years, at the time they were undertaking their 5-year projections five years ago (i.e. around 2014). All of the forecasters expected all-industries wages growth to recover and accelerate markedly within 2-3 years. Basically, the forecasters missed the structural change that was occurring in inflation and wages growth at that time and assumed that the deceleration in wages in FY14 was a cyclical phenomena, and that both the CPI and wages would pick up over the medium - term with the expected recovery in the economy.

In relation to the utilities-all-industries WPI differential, DAE forecast that utilities wages would be lower than the all-industries WPI, particularly over years 3-5 of the 5-year forecast period (forecasting the gap would be -0.4% to -0.5% lower in those 3 latter years). As Figure 1 shows, the actual gap was +0.2% to +0.5% higher than the all-industries WPI. Only FY18 was lower, by -0.1% - which was only the second time in the past 20 years that the utilities WPI has been lower than the all-industries WPI (it was also -0.1% lower in FY12). Our analysis of DAE utilities forecasts reveals that DAE usually has utilities WPI growth outpacing all-industries WPI in the first 1-2 years, then it subsequently falls below the all-industries WPI growth. They have done this in virtually every year they have provided reports to the AER – despite the long trend of utilities outpacing all industries WPI. This suggests a serious mis-specification in their sectoral wage model.

As DAE historically forecast (incorrectly) that the utilities' WPI would be materially lower than the all-industries WPI (as it invariably has done over the past 12 years), DAE's forecast error of the gap was largely offset by its error in over-estimating all-industries wages. This then made its overall utilities forecast *appear* more accurate than BISOE's forecast of utilities wages. We would argue that DAE's *apparent* superior forecasting record was not due to superior modelling of utility sector wages. It was because their incorrect modelling of the relationship between utilities and all-industries wages was compensated by their over-estimation of all-industries wages – essentially it was a forecasting 'fluke'.

Fig. 1. Real EGWWS WPI v All Industries WPI - History



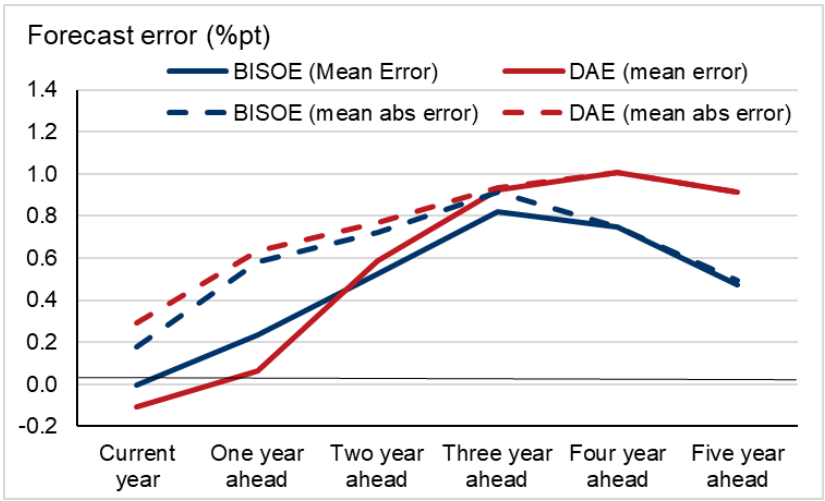
Alternative approach and results

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 by 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 2 below.

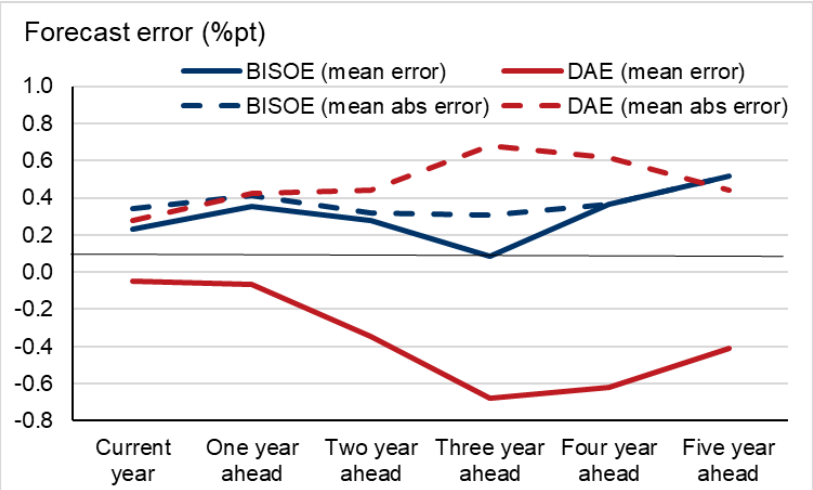
Fig. 2. BISEOE and DAE forecast performance, all-industries WPI



- For the EGWWS-all-industries 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 EGWWS-all-industries 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 EGWWS-all-industries gap is illustrated in Figure 3 below.

Fig. 3. BISOE and DAE forecast performance: EGWWS-all-industries 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 EGWWS-all-industries 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 EGWW-all industries 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.

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.

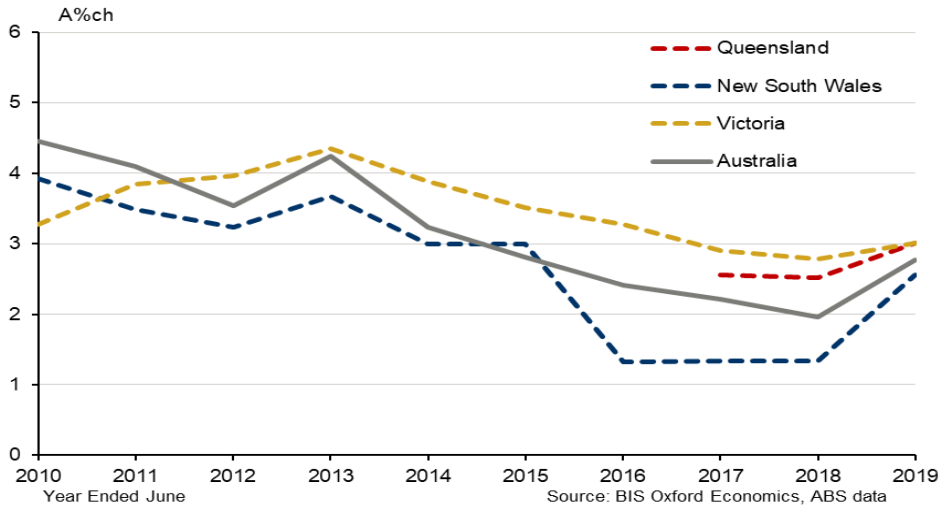
Given these observations, the **AER's current approach of averaging the projections from DAE and BISOE is statistically likely to produce the most accurate projections for wage increases over the forward-looking horizon.** Therefore, **our conclusion** is that **there is no compelling reason to change the AER's current approach of averaging the forecasts.**

Assessment of recent data and outlook

As noted in the AER's draft determination, 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, the FY19 rebound in real wage growth to 1.1% from 0.1% in FY18, saw the differential between the EGWWS WPI and all-industries WPI jumping back to 0.5%, with the average differential for the past five years averaging +0.3% - in line with historical norms (see figure 1).

Fig. 4. Electricity, Gas, Water and Waste Services Wage Price Index, Australia, New South Wales, Victoria and Queensland (nominal terms)



Looking ahead, in line with the views of a number of commentators, 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 period from 2005 to 2013), as a result of competition from the mining and construction sectors 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. This report is in response to Jemena Gas Networks request that BIS oxford Economics to "replicate the methodology adopted in the AER analysis, as set out in the AER's *Draft Decision, SA Power Networks Distribution Determination 2020 to 2025*, and advise whether it is reasonable to come to the same conclusion made by the AER. In doing so consider the merits and alternatives to mean error and absolute mean error in comparing the DAE and BIS measures."

We begin with an assessment of the AER's approach to assessing the forecast performance of the two firms, highlighting deficiencies in the approaches used by the AER. We then present the results from our nominated approach to assessing the projections. Finally, we assess whether the AER should actually change its current approach of averaging the two forecasters' wage forecasts and we also provide an assessment of the implications of adopting the AER's proposal to only use DAE projections going forward.

2. ASSESSMENT OF AER COMPARISON EXERCISE

2.1 AUSTRALIAN ENERGY REGULATOR APPROACH

As part of their draft decision for SA Power Network's next regulatory period, the AER 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 Australian 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 SA Power Network 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 at the state level.

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 SA Power Networks (or JGN, or other utilities) in their 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 **differential (gap) in wages growth 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 a 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.

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.

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

The upshot of their model means that forecasts of utilities wages will always drift lower than the national (all industries) wage growth because utilities output (real gross value added) is invariably lower than the national average (i.e. GDP) and because utilities labour productivity growth is invariably lower than the national average. It is likely that DAE applies their user adjustment in the near-term to push utilities wages growth upwards (compared to the modelled output) because at the starting point (latest actual) utilities wages growth is usually higher than all industries wages growth at that time.

Given that utilities output and productivity growth have invariably been lower than the national average, but utilities wages growth has invariably been higher than the national average, one can conclude that the DAE model for utilities wages is mis-specified.

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 SA Power Networks 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. ALTERATIVE 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 but with the issues of forecast horizon and sample bias highlighted in Section 2.2.2 addressed.

Fig. 5. Forecast performance using AER approach – EGWWS WPI

	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 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 with which to compare), 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 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

[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.

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 – All Industries WPI Comparison

Fig. 6. Forecast deviations in real all-industries WPI

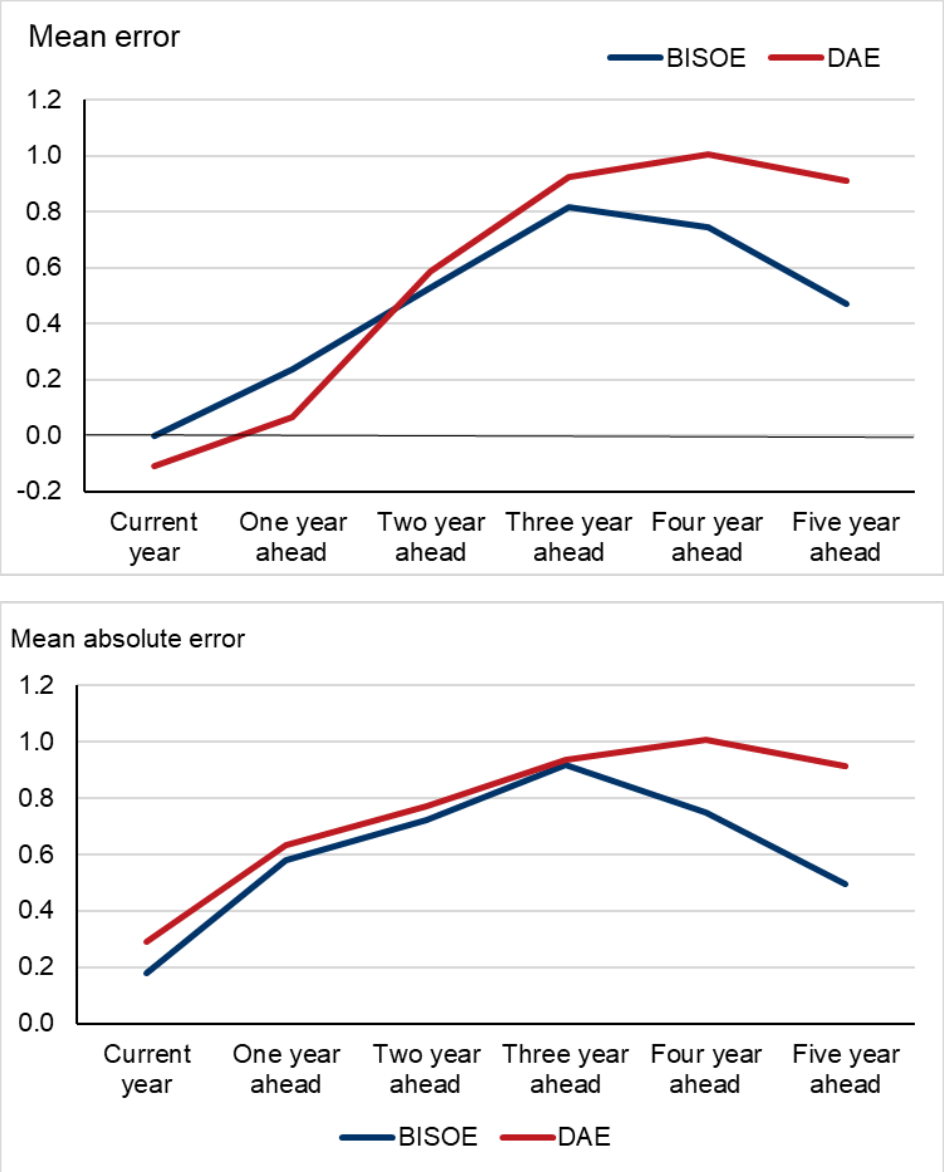
	Mean error		Mean absolute error	
	BISOE	DAE	BISOE	DAE
Current year	0.0	-0.1	0.2	0.3
One year ahead	0.2	0.1	0.6	0.6
Two year ahead	0.5	0.6	0.7	0.8
Three year ahead	0.8	0.9	0.9	0.9
Four year ahead	0.7	1.0	0.7	1.0
Five year ahead	0.5	0.9	0.5	0.9

Figure 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 7).
- 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. 7. 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 decision, 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 average

[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).

the forecast errors presented in Figure 7. 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.

3.2.2 Stage two forecast assessment: EGWWS-All Industries Differential

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. 8. Forecast deviation in EGWWS-All Industries differential

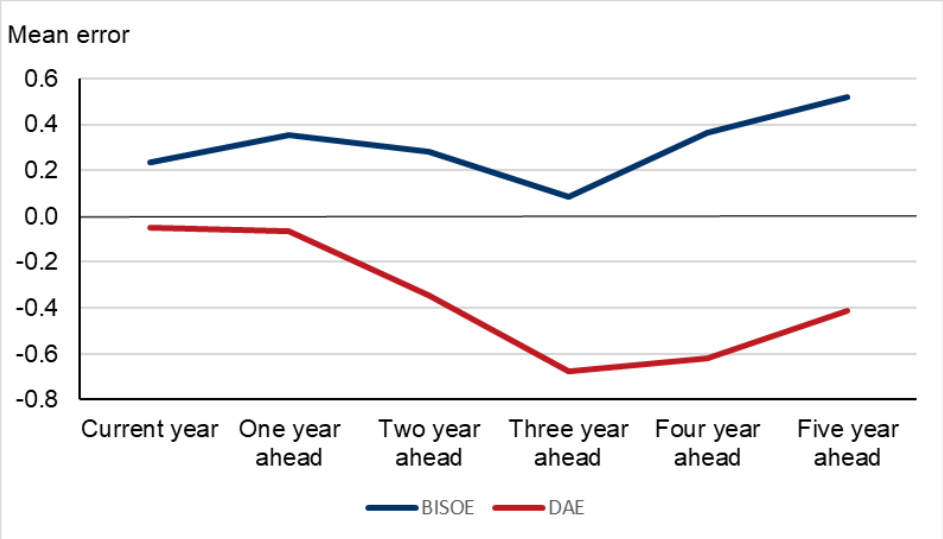
	Mean error		Mean absolute error	
	BISOE	DAE	BISOE	DAE
Current year	0.2	0.0	0.3	0.3
One year ahead	0.4	-0.1	0.4	0.4
Two year ahead	0.3	-0.3	0.3	0.4
Three year ahead	0.1	-0.7	0.3	0.7
Four year ahead	0.4	-0.6	0.4	0.6
Five year ahead	0.5	-0.4	0.5	0.4

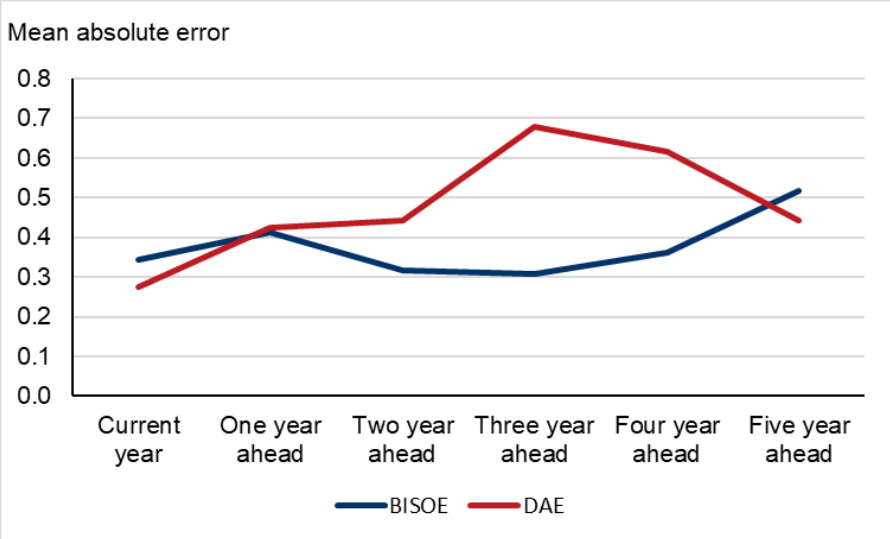
As was found in the first stage of the analysis, the forecast performance of both firms worsens as the forecast horizon increases, as expected. We note the following specific observations:

- 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 error and mean absolute error measures together, the BISOE forecasts exhibit some upward bias in the forecasted EGWWS-all-industries gap, particularly in the long run (years four and five). In contrast, the DAE forecasts exhibit downward bias.

These points can be seen in Figure 9 below.

Fig. 9. EGWWS-All Industries 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 EGWWS-all-industries 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 EGWWS-all-industries 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 10), 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. 10. Mean forecast error comparison: EGWWS-All Industries WPI

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 (see figure 11[6]).

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. 11. Cumulative forecast error: sum of all-industries error + gap (differential) of EGWW-All Industries

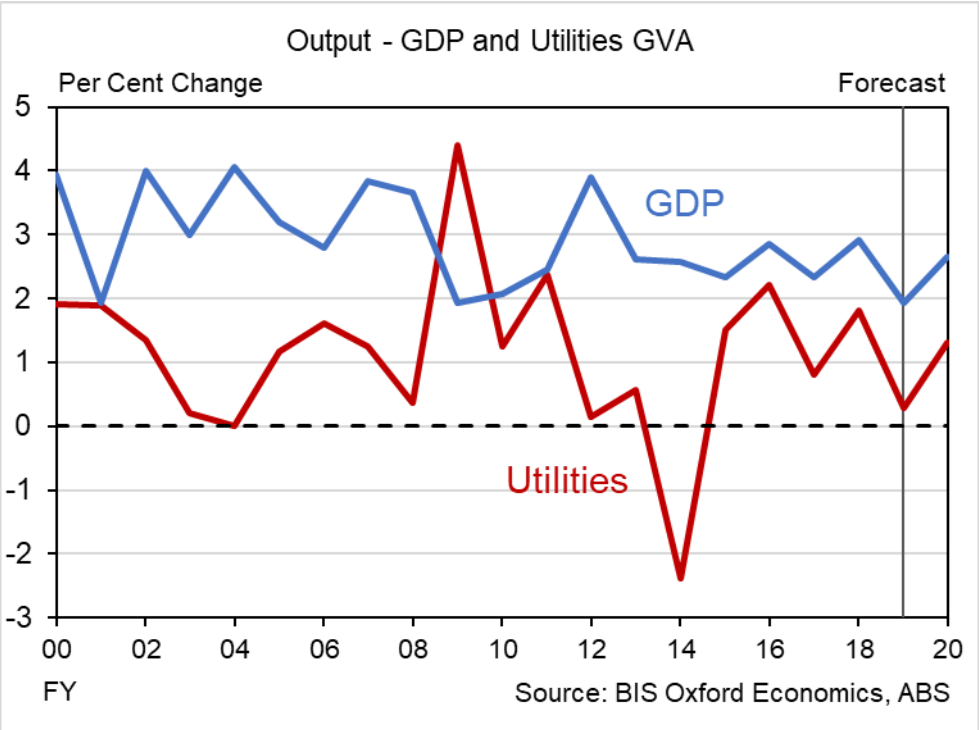
	Mean error		Mean absolute error	
	BISOE	DAE	BISOE	DAE
Current year	0.2	-0.2	0.5	0.6
One year ahead	0.6	0.0	1.0	1.1
Two year ahead	0.8	0.2	1.0	1.2
Three year ahead	0.9	0.2	1.2	1.6
Four year ahead	1.1	0.4	1.1	1.6
Five year ahead	1.0	0.5	1.0	1.4

[6] Note that the values in figure 11 are the sum of those in figures 6 and 8. The net impact of this generates a mean error that is the same as that found in the AER approach (as per figure 5).

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.

Fig. 12. Output – Utilities GVA v. GDP



The actual outturn for the EGWWS-all-industries 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 output 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 (65% of utilities' employees are covered by a collective agreement, compared to 38% 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 forecast implicitly understates the importance of short run, cyclical factors in determining EGWWS wages. In particular, we note that we underestimated the ongoing impact of the one-off privatisation event which 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). Over these 3 years, the average wage rises in the NSW utilities sector were well below the national average. This appears to be a 'one-off' aberration, and may have been related to downward pressure on wages from the NSW state government (particularly wage increases in the areas outside collective agreements) before, during and immediately following the privatisation of the NSW electricity businesses. Prior to 2015, the NSW utilities wage increases were usually close (on average) to the national average.

Over the past four-to-six quarters, wage rises in the NSW utilities sector have recovered, back to near the q/q national rises. We expect this trend to continue, and for wage rises in the NSW utilities sector to track close to the national average. Wider pressures in the overall state labour market – the current NSW unemployment rate is well below the national average, and we expect the state unemployment rate to remain below or close to the national average - will also ensure that wage rises will tend to track the national average at the broader (all industries) level, as well as putting pressure on certain industries such as the electricity sector with its higher skill demands.

We also expect some degree of 'catch-up' to occur, especially in relation to the Victorian utilities sector, where wage rises over recent years have significantly outpaced the NSW utilities wage increases (and national average). The NSW utilities businesses will find they need to offer higher wages to local workers and keep pace with interstate utilities wages growth to both avoid losing workers interstate and to attract workers from interstate with the necessary requisite skills.

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 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 EGWWS-all-industries 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 EGWWS-all industries 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.

We also note 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 EGWWS-all industries gap. For this series, the mean forecast error at every time horizon apart from three years ahead[7] 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 by the EGWWS wage gap produced by BISOE and DAE,

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

the average of the two will (based on historical performance) be a more accurate estimate of the profile for the national EGWWS WPI.

When looking at the historical forecast performance of both firms together, the average forecast performance is materially better than either firm individually. This is because the tendency to understate the EGWWS gap from DAE is offset against the tendency to overstate the EGWWS gap by BISOE.

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. Therefore, this is consistent with the forecasting and estimate requirement under the National Gas Rules r.74 (2), that:

"A forecast or estimate:

(a) Must be arrived at on a reasonable basis; and
(b) Must represent the best forecast or estimate possible in the circumstances."

Therefore, our conclusion is that there is no compelling reason to change the AER's current approach of averaging the forecasts.

The key implication of the potential decision to only use DAE forecasts is that this risks the AER consistently producing less accurate projections for the efficient labour costs of Jemena Gas Networks. This could result in the firm being unable to recover the efficient costs associated with the expenditure objectives as set under the National Gas Rules.

Going Forward – if All industries Wage Forecasts are correct, then DAE will understate Utilities Wage Growth

As mentioned, the main reason DAE forecasts of utilities wages were a lot closer to the actual outcome was because DAE (and BISOE and Treasury, etc) over-stated national wage growth by a considerable margin. With their usual downward bias of their sectoral model, this saw the DAE forecast of utilities wages be closer to the actual.

Going forward, if DAE (and/or BISOE, Treasury) were to get the forecast of All industries wage growth correct, then DAE would significantly under-estimate utilities wages growth over most of the forecast horizon – particularly years 2 to 6 (or 3 to 7, depending on the date of forecast) which coincides with the regulatory period.

The latest available published forecasts for DAE are June 2019 (as provided by the AER in its draft decision) and for Treasury the Budget Papers for 2019-20 (April 2019). BISOE has amended its all-industries and EGWWS WPI forecasts in September 2019. All three forecasters have their all-industries wages slowly picking up over the next 2 years before picking up to around 3 ½ % by 2022-23, although DAE has a lower peak of 3.1% in 2022-23. There is not a large amount of deviation in the national forecasts.

However, in terms of utilities wages, DAE once again has its usual pattern of utilities wage growth tracking below and staying below national wages growth after 2020-21. On past performance this would under-estimate utilities wages growth **if** the national all-industries WPI growth forecasts came to fruition. We

believe that utilities wages growth will continue to outpace All Industries wage growth by an average of 0.3% to 0.4%, somewhat in line with historical averages, including receiving an extra boost from strong wages growth in the mining and construction sectors over 2022 to 2024 (similar to the 2006 to 2013 period).

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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