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Memorandum

To:	ActewAGL Distribution (AAD)
From:	CEG – Asia Pacific
Date:	11 May 2016
Subject:	**Cost of debt calculations**
Status:	~~Privileged and confidential~~

1 Purpose

1. This memo provides estimates of the return on debt using a trailing average approach (0% swaps hedging) and an optimal hedging approach (33% swaps hedging) for the 2015/16 and 2016/17 financial years.[1]

2 Return on debt estimates

2. The return on debt under the trailing average approach is obtained as the sum of:

   - the 10-year trailing average debt risk premium; and
   - the 10-year trailing average of 10-year swap rates.

3. The return on debt under the 100% swaps approach is obtained as the sum of:

   - the 10-year trailing average debt risk premium;
   - swap transaction costs on the transition component, estimated at 11.5 bp in the first year and declining by 1.15 bp in each subsequent transition year (down to zero by the end of the transition); and
   - the *x*-to-10 year swap rate over the averaging period for the first year of the transition period, where *x* is the year of the transition period for which the prevailing return on debt is being calculated, and the averaging period for the first year of the transition period for AAD is 4 June 2015 to 25 June 2015.

[1] The choice of 33% swaps as an optimal hedging ratio is obtained from a CEG report: CEG, Efficient use of interest rate swaps to manage interest rate risk, June 2015.

4. The return on debt under the optimal hedging approach is then the weighted average of the trailing average approach (67% weight) and the 100% swaps approach (33% weight).

5. Consistent with instructions, we estimate the DRP as follows:

   - For each of the 2006/07 to 2014/15 regulatory years, we use the averaging period of the preceding full financial year and the simple average of the Bloomberg and RBA estimates;
   - For the 2015/16 regulatory year, we use the averaging period of 4 June 2015 – 25 June 2015 and the RBA estimate; and
   - For the 2016/17 regulatory year, we use the averaging period of 9 March 2016 – 31 March 2016 and the simple average of the Bloomberg, RBA, and Reuters estimates.

2.1 Data

6. Table 2-1 shows the DRP estimates from each of the three sources over AAD's averaging periods for each of the 2006/07 to 2016/17 regulatory years.

Table 2-1: Debt risk premium (semi-annual)

Regulatory year	Averaging period	Bloomberg	RBA	Reuters	Proposed
1 Jul 2006 – 30 Jun 2007	1 Jul 2005 – 30 Jun 2006	0.642*	0.652		0.647
1 Jul 2007 – 30 Jun 2008	1 Jul 2006 – 30 Jun 2007	0.613*	0.779		0.696
1 Jul 2008 – 30 Jun 2009	1 Jul 2007 – 30 Jun 2008	1.417*	1.897		1.657
1 Jul 2009 – 30 Jun 2010	1 Jul 2008 – 30 Jun 2009	3.355*	5.432		4.393
1 Jul 2010 – 30 Jun 2011	1 Jul 2009 – 30 Jun 2010	3.116	2.504		2.810
1 Jul 2011 – 30 Jun 2012	1 Jul 2010 – 30 Jun 2011	3.514	2.000		2.757
1 Jul 2012 – 30 Jun 2013	1 Jul 2011 – 30 Jun 2012	3.069	2.977		3.023
1 Jul 2013 – 30 Jun 2014	1 Jul 2012 – 30 Jun 2013	2.801	2.960		2.881
1 Jul 2014 – 30 Jun 2015	1 Jul 2013 – 30 Jun 2014	2.469	2.967		2.718
1 Jul 2015 – 30 Jun 2016	4 Jun 2015 – 25 Jun 2015	1.780	1.900		1.840
1 Jul 2016 – 30 Jun 2017	9 Mar 2016 – 31 Mar 2016	2.656^	2.851^	2.848^	2.785

*Source: Bloomberg, RBA, Reuters, CEG analysis; *^See footnote;*[2]

[2] The numbers indicated by an asterisk (*) differ slightly from the ones in our previous memorandum for AAD due to a change in methodology. The AER's approach for extrapolating the Bloomberg BFV curve to 10 years uses the margin between the RBA's 10 year spread to swap estimate and the estimate that corresponds to the longest tenor available on the BFV curve.

For months where the RBA does not publish a 10-year estimate, the previous memorandum simply omitted the Bloomberg BFV estimate if the curve did not extend to 10 years. The numbers in Table 2-1 address this differently by linearly extrapolating using the margin between the two longest BFV spreads

7. Table 2-2 shows the historical 10-year swap rates for AAD's averaging periods for each of the 2006/07 to 2016/17 regulatory years.

Table 2-2: Historical 10-year swap rates (semi-annual)

Regulatory year	Averaging period	Average rate
1 Jul 2006 – 30 Jun 2007	1 Jul 2005 – 30 Jun 2006	5.859
1 Jul 2007 – 30 Jun 2008	1 Jul 2006 – 30 Jun 2007	6.313
1 Jul 2008 – 30 Jun 2009	1 Jul 2007 – 30 Jun 2008	7.037
1 Jul 2009 – 30 Jun 2010	1 Jul 2008 – 30 Jun 2009	5.612
1 Jul 2010 – 30 Jun 2011	1 Jul 2009 – 30 Jun 2010	6.054
1 Jul 2011 – 30 Jun 2012	1 Jul 2010 – 30 Jun 2011	5.836
1 Jul 2012 – 30 Jun 2013	1 Jul 2011 – 30 Jun 2012	4.782
1 Jul 2013 – 30 Jun 2014	1 Jul 2012 – 30 Jun 2013	3.920
1 Jul 2014 – 30 Jun 2015	1 Jul 2013 – 30 Jun 2014	4.396
1 Jul 2015 – 30 Jun 2016	4 Jun 2015 – 25 Jun 2015	3.370
1 Jul 2016 – 30 Jun 2017	9 Mar 2016 – 31 Mar 2016	2.704

Source: Bloomberg, CEG analysis

8. Table 2-3 shows the *x*-to-10 year swap rates averaged over AAD's averaging period for the 2015/16 financial year. For example, the 1-to-10 year average swap rate is the average of the 1-, 2-, …, and 10-year swaps, while the 5-to-10 year average swap rate is the average of the 5-, 6-, …, and 10-year swaps.

to swap available. This, in our view, is a better approach that should be relied upon since it makes full use of the available data.

The numbers indicated by a caret (^) differ from the previous memorandum, which used September 2015 as a placeholder averaging period since AAD's averaging period had not occurred at the time of drafting. The numbers in Table 2-1 are updated values based on AAD's actual averaging period.

See: CEG, Memorandum to ActewAGL: September 2015 cost of debt and inflation forecasts (Appendix 5.10), January 2015.

Table 2-3: Swap rates averaged over 4 June 2015 – 25 June 2015 (semi-annual)

	Average rate
1 – 10 year	2.807
2 – 10 year	2.872
3 – 10 year	2.946
4 – 10 year	3.020
5 – 10 year	3.093
6 – 10 year	3.160
7 – 10 year	3.221
8 – 10 year	3.275
9 – 10 year	3.325
10 year	3.370
10 year (9 Mar 2016 – 31 Mar 2016)	2.704

Source: Bloomberg, CEG analysis

2.2 Estimates

9. The return on debt estimates for the 2015/16 and 2016/17 regulatory years are shown in Table 2-4 for the trailing average and optimal hedging approaches. The DRP component of each approach is the same (see second column from right) with the only difference relating to the base rate (which is affected by the assumed hedging strategy).

10. The swap rates under the trailing average approach are calculated as the average of the most recent 10 years as shown in Table 2-2, while the swap rates under the 100% swaps approaches are calculated as a weighted average of the x-to-10 year swap rates in the first 10 rows of Table 2-3 (weight of $(1.1 - 0.1x)$) and the swap rate shown in the last row of Table 2-3 (weight of $(0.1x - 0.1)$).

11. For example, the swap rate under the 100% swaps approach for the 2015/16 regulatory year is simply the first row of Table 2-3 (2.807), while the swap rate for the 2016/17 regulatory year is 0.9*2.872 + 0.1*2.704 = 2.85.

12. The estimates for the 100% swaps approach includes 11.5 bp transaction costs in the first transition year 2015/16,[3] which declines by 10% for each subsequent year, such that the transaction cost for 2016/17 is 10.4 bp.

[3] We retain the same assumption of 11.5 bp swap transaction costs, which we used in our previous memorandum to AAD. See: CEG, Memorandum to ActewAGL: September 2015 cost of debt and inflation forecasts (Appendix 5.10), January 2015.

Table 2-4: Return on debt estimates for 2015/16 and 2016/17

Transition year	Regulatory year	Swap rate	Transaction costs	DRP	Cost of debt	Annual. Cost of debt
Trailing average	2015/16	5.32	-	2.34	7.66	7.81
	2016/17	5.00	-	2.56	7.56	7.70
100% swaps	2015/16	2.81	0.115	2.34	5.26	5.33
	2016/17	2.85	0.104	2.56	5.51	5.59
Optimal hedging	2015/16	4.48	0.038	2.34	6.86	6.98
	2016/17	4.29	0.035	2.56	6.89	7.00

Source: Bloomberg, RBA, Reuters, CEG analysis

2.3 Historical cost of debt component

13. Starting with the 2016-17 regulatory year, the return on debt can alternatively be formulated as follows:

    a. For regulatory year 2016-17: $kd_{2016\text{-}17} = H_{2016\text{-}17}$;

    b. For regulatory year 2017-18: $kd_{2017\text{-}18} = (0.9 \times H_{2017\text{-}18}) + (0.1 \times R_{2017\text{-}18})$;

    c. For regulatory year 2018-19: $kd_{2018\text{-}19} = (0.8 \times H_{2018\text{-}19}) + (0.1 \times R_{2017\text{-}18}) + (0.1 \times R_{2018\text{-}19})$;

    d. For regulatory year 2019-20: $kd_{2019\text{-}20} = (0.7 \times H_{2019\text{-}20}) + (0.1 \times R_{2017\text{-}18}) + (0.1 \times R_{2018\text{-}19}) + (0.1 \times R_{2019\text{-}20})$;

    e. For regulatory year 2020-21: $kd_{2020\text{-}21} = (0.6 \times H_{2020\text{-}21}) + (0.1 \times R_{2017\text{-}18}) + (0.1 \times R_{2018\text{-}19}) + (0.1 \times R_{2019\text{-}20}) + (0.1 \times R_{2020\text{-}21})$.

14. Under this formulation, $H_{i\text{-}j}$ represents the component of the trailing average return on debt that is known at the end of AAD's averaging period for estimating the prevailing return on debt for the 2016/17 regulatory year, while $R_{k\text{-}l}$ is the component that is not currently known.

2.3.1 Trailing average (0% swaps) approach

15. For the 2016/17 regulatory year shown in paragraph 13(a), the trailing average return on debt is fully known based on a 10-year trailing average cost of debt starting in the 2007/08 regulatory year and ending in the 2016/17 regulatory year (inclusive) where:

    - the cost of debt for the 2007/08 to 2014/15 regulatory years is calculated over the preceding full financial year;
    - the cost of debt for the 2015/16 regulatory year is calculated over AAD's averaging period of 4 June 2015 to 25 June 2015; and

- the cost of debt for the 2016/17 regulatory year is calculated over AAD's averaging period of 9 March 2016 to 31 March 2016.

16. Given that all of this is known, the return on debt for the 2016/17 regulatory year is equal to $H_{2016\text{-}17}$.

17. For the 2017/18 regulatory year shown in paragraph 13(b), the trailing average return on debt assigns 90% weight to the 9-year trailing average of the cost of debt for the regulatory years 2008/09 through 2016/17, which is known. This is denoted as $H_{2017\text{-}18}$, and has all the same inputs as $H_{2016\text{-}17}$ except that the cost of debt for the 2007/08 regulatory year is removed. The remaining 10% weight will only be known at the end of AAD's averaging period for the 2017/18 regulatory year, and is denoted $R_{2017\text{-}18}$.

18. With the remaining regulatory years, the return on debt is calculated as a 10-year trailing average, with each known component having 10% less weight in each subsequent year, along with the removal of the earliest year in the previous $H_{i\text{-}j}$. In turn, one additional $R_{k\text{-}l}$ term is added with 10% weight based on the cost of debt in that year k-l.

2.3.2 Optimal hedging (1/3 swaps) approach

19. The optimal hedging approach is a weighted average of the trailing average (0% swaps) and hybrid (100% swaps) approaches, with the former receiving 2/3 weight and the latter receiving 1/3 weight.

20. Under the 100% swaps approach, the return on debt for the 2016-17 regulatory year consists of 90% weight being given to the sum of:

- the 9-year trailing average DRP for the regulatory years 2007/08 through 2015/16 (with the full preceding financial year being used as the averaging period for the regulatory years 2007/08 to 2014/15 and AAD's averaging period of 4 June 2015 to 25 June 2015 being used for the 2015/16 regulatory year);
- the average of 2-10 year swap rates (inclusive) calculated over 4 June 2015 to 25 June 2015; and
- 11.5 bp transaction costs.

21. The remaining 10% weight is given to the average cost of debt over 9 March 2016 to 31 March 2016. This weighted average forms $H_{2016\text{-}17}$ under 100% swaps.

22. For the 2017-18 regulatory year, the 100% swaps approach assigns 80% weight to the sum of:

- the 8-year trailing average DRP for the regulatory years 2008/09 through 2015/16;

- the average of 3-10 year swap rates (inclusive) calculated over 4 June 2015 to 25 June 2015; and
- 11.5 bp transactions costs.

23. The remaining 20% weight is a 2-year trailing average cost of debt for the 2016/17 and 2017/18 regulatory years, of which the first 10% is calculated over 9 March 2016 to 31 March 2016, and is currently known. Thus, $H_{2017\text{-}18}$ under the 100% swaps approach is the sum of the components with 80% weight and the known 10%, normalised to 100% by dividing by 0.9. The return on debt for the 2017/18 regulatory year can then be calculated as a weighted average of $H_{2017\text{-}18}$ and $R_{2017\text{-}18}$ (the currently unknown cost of debt in the third year of transition), with each receiving 90% and 10% weight respectively, as was explained previously.

24. Finally, the optimal hedging approach is simply a weighted average of $H_{i\text{-}j}$ under the trailing average and 0% swaps approaches.

2.3.3 Estimates of $H_{i\text{-}j}$ under both approaches

25. The estimates of $H_{i\text{-}j}$ under the trailing average and optimal hedging approaches are shown in Table 2-5.

Table 2-5: $H_{i\text{-}j}$ under trailing average and optimal hedging approaches, semiannual

Regulatory year	$H_{i\text{-}j}$ (Trailing average)	$H_{i\text{-}j}$ (100% swaps)	$H_{i\text{-}j}$ (Optimal hedging)	Weight
2016-17	7.56	5.51	6.88	1.0
2017-18	7.62	5.78	7.01	0.9
2018-19	7.49	5.98	6.98	0.8
2019-20	7.13	5.82	6.69	0.7
2020-21	6.84	5.85	6.51	0.6
2021-22	6.48	5.86	6.28	0.5
2022-23	6.15	5.77	6.03	0.4
2023-24	5.94	5.64	5.84	0.3
2024-25	5.35	5.41	5.37	0.2
2025-26	5.49	5.49	5.49	0.1

Source: Bloomberg, RBA, Reuters, CEG analysis