MODEL SMOOTHING – INVESTIGATIVE ANALYSIS

1.0 Background

The application of model smoothing was first undertaken in formulating the NDM proposals for 1999/00. Model smoothing has since been applied to the NDM proposals for all subsequent years, and most recently for 2020/21.

It was agreed with the Demand Estimation Sub-Committee (DESC) and Ofgem shortly after the first application of model smoothing that the method applied would be subject each year to the scrutiny of DESC and that the results of successive years of demand modelling (feeding into model smoothing) would be examined for evidence of trends if any, so as to inform decisions on the approach to and mode of application of model smoothing in future years.

The first such investigative analysis was undertaken in autumn 1999 and in the light of those results it was decided to retain model smoothing without change for deriving the NDM proposals for 2000/01. Further investigations of model smoothing were undertaken during each autumn thereafter (in each of the years from 2000 to 2005) and following discussion of those results at DESC on each occasion, it was decided to continue to apply model smoothing in deriving the NDM proposals for the forthcoming year.

In January 2006, DESC agreed to move to a biennial assessment of the continued applicability of model smoothing. Accordingly, the last formal assessment of model smoothing undertaken was in autumn 2018. Following discussion of those results at DESC in October 2018, it was decided to continue to apply model smoothing in deriving the NDM proposals for 2019/20 and 2020/21.

The proposals for 2020/21 having been finalised, it is now appropriate to undertake a re-assessment so that informed decisions on the continued future application of model smoothing can be taken.

This note is a full formal assessment of model smoothing along the lines undertaken two years ago.

Please note the following: All analysis throughout this document has been performed on the new CWV formula and Seasonal Normal basis implemented on 1st October 2020, as such, retrospective data is only available for gas year 2016/17 onwards.

Due to insufficient data, new EUCs added to Bands 1 and 2 since Gas Year 2019/20 have not been included in the assessment. The traditional Band 1 Domestic EUC (01BND) and Band 2 Non Domestic EUC (02BNI) have been included

2.0 Principles of Model Smoothing

Model smoothing was introduced because EUC models were exhibiting some year on year volatility. It was therefore anticipated that averaging more than one year's models would achieve greater stability.

A further obvious aspiration for the EUC models is that of improved accuracy. However, the two objectives of stability and accuracy are not necessarily consistent: if there is an underlying drift in customer behaviour which leads to changes in model characteristics then stability may be achieved at the expense of accuracy.

It is proposed here (as in the investigative analyses undertaken in all previous occasions) that accuracy is defined as the capability of a model (or a smoothed model) to predict the model that will be fitted to the following year's data.

In order to attempt to illuminate this aspect it is possible to perform the following test on EUC models:

Compare the models fitted to the (single year) 2019/20 consumption data with:

- the 2018/19 (single year) models
- the smoothed models based on 2016/17, 2017/18 and 2018/19 data

The test has been applied to CWV intercepts, which give a simple indication of weather sensitivity - i.e. high CWV intercept implies low weather sensitivity. For each case root mean square (RMS) values of the CWV intercept differences have been computed.

For this year's investigation of model smoothing the CWV intercepts from the analyses of the data sets for 2016/17, 2017/18 and 2018/19 along with those for 2019/20, provide the necessary information. All of these CWV intercepts relate to models derived using the revised definitions of CWVs and the revised basis for SNCWVs that were used in the spring 2020 NDM analysis and which came into effect on 1st October 2020. In general, for EUCs in LDZs where a CWV definition has changed, the CWV intercepts presented here are not directly comparable with CWV intercepts published prior to the change of CWV definition. In addition, the current definitions of holiday codes (implemented in the spring 2011 analysis) were applied in deriving the models for all the years.

3.0 Analysis

3.1 Predictive Ability Analysis – Consumption Bands (Figures 1 & 2)

The bar charts attached as Figures 1 and 2 shows, for the small and large NDM consumption band EUCs only, the difference between the respective CWV intercepts on the two bases.

For the small NDM consumption band EUCs (Figure 1) the bar chart for the smoothed model for 2019/20 (based on 2016/17, 2017/18 and 2018/19 data) is slightly better, in terms of the spread of CWV intercept differences, when compared with those for the single year (2018/19) model, and this is also reflected in the respective RMS values, which are marginally better for the smoothed model.

For large NDM consumption band EUCs (Figure 2) the spread of CWV intercept differences and RMS values are fractionally better for the singe year model. Note, results shown for large NDM exclude the contribution of band 09B.

Overall, for small NDM consumption band EUCs, the smoothed three-year model is slightly better at predicting 2019/20 than the single year (2018/19), whilst for the large NDM consumption band EUCs, the smoothed model performed fractionally worse.

3.2 Predictive Ability Analysis – All EUCs incl. WAR bands (Figures 3 & 4)

This analysis has also been extended to include WAR band EUCs, the results from which are shown in Figures 3 and 4. The spread of CWV intercept differences, for all small NDM EUCs (Figure 3), for the single year model case and smoothed model case are quite similar, however the RMS value (indicating the spread of CWV intercept differences around zero) is slightly higher for the smoothed model.

For all large NDM EUCs (Figure 4) the spread of CWV intercept differences for the smoothed model case is like the single year model case, however the relevant RMS values (excluding band 09B) are better for the smoothed model.

This analysis of "predictive ability", undertaken on the same basis as previous years, has shown overall that the single year model for small NDM EUCs was marginally better than the smoothed model. However, it has also shown the smoothed model for large NDM EUCs was better than the single year model.

The main driver for using a smoothed model is the mitigation of year of year volatility rather than predictive capability.

3.3 Year on Year Volatility Analysis (Figures 5, 6, 7 & 8)

In order to assess this a similar test has been applied to observe the year-on-year volatility of

smoothed models as against individual years' models. The bar charts in Figures 5 & 7 (small NDM) and Figures 6 & 8 (large NDM) show:

- Difference in CWV intercepts between the smoothed models applicable to gas year 2019/20 (based on 2016/17, 2017/18 and 2018/19) and the smoothed models applicable to gas year 2020/21 (based on 2017/18, 2017/18 and 2019/20).

- Difference in CWV intercepts between individual year models for 2018/19 and 2019/20 that would have been applied to gas years 2019/20 and 2020/21 respectively if model smoothing had not been implemented.

The results in Figures 5 and 6 relate to both consumption band and WAR band EUCs, while the results in Figures 7 and 8 relate to just the consumption band EUCs.

As expected, the smoothed models are associated with notably lower year-on-year volatility for both small and large NDM EUCs. This is evident in the generally narrower distribution of CWV intercept differences and the notable reductions in corresponding RMS values, visible in all 4 charts.

4.0 Model Smoothing – Average or Trend (Figure 9, Table 1, 2 & 3)

On each occasion when this investigation of model smoothing has been carried out, there has been some discussion as to whether model averaging or model extrapolation is more appropriate. Extrapolation would only be worthy of consideration if a clear trend could be detected. There has also been some discussion in previous years about whether a trend based on a limited number of years' data should be regarded as a reliable basis for extrapolation.

An analysis of CWV intercepts (all of which are on the current weather basis) is attached which attempts to shed some light on whether trends exist. This analysis is usually presented to DESC every two years (last presented to DESC in autumn 2018). However, for a complete view of CWV intercepts from one year to another, the summary results of this CWV intercept analysis undertaken on an annual basis must be included and this has been done in the results presented here for all available years.

The CWV intercept analysis has been applied to all EUCs, small and large NDM, including both consumption band and WAR band EUCs. Figure 9 shows the classification scheme that has been applied to the individual years comprising the smoothed models for gas year 2020/21 - essentially there are five possible patterns for a series of three CWV intercepts to follow:

- UP/ UP (UU)
- DOWN / UP (DU)
- FLAT (F)
- UP / DOWN (UD)
- DOWN / DOWN (DD)

A code has been associated with each of the patterns, and Table 1 shows how each EUC is classified. In Table 2, the counts of each type are shown, firstly a count by EUC across the LDZs, and secondly a count by LDZ across the EUCs.

For the analysis years 2017/18, 2018/19 and 2019/20, the overall count of the different pattern types indicates that:

- The "up/up", pattern shows 35 occurrences out of 429, compared to 163 in 2019.

- The "down/down" pattern shows 75 occurrences, compared to 13 in 2019.

- The majority of instances show no increasing or decreasing pattern over the 3 years i.e. either "up/down" or "down/up", with 280 occurrences out of 429 (there were 214 in 2019).

- This year also shows 39 flat or nearly flat models which has remained constant from 2019.

"Down/up" and "up/down" patterns account for 65% (280) of the total number of cases (429), up from just under 50% (214 of 429) in 2019. Since there are 39 cases of flat or nearly flat models (all of which

are EUCs applicable to WAR band 1) 280 of 390 remaining cases show no consistent pattern over three years. Instances with a decreasing pattern or an increasing pattern over three years amount to 110, down from 176 in 2019.

There were 0 instances of EUCs where there is an increasing pattern over three years in a majority of LDZs (i.e. 7 or more of 13). There were 2 instances of EUCs where there is a decreasing pattern in a majority of LDZs. Alternatively, there were 0 LDZs which showed an increasing or decreasing pattern in the majority of EUCs (17 or more). There was a notable decrease generally in the total number of EUCs that displayed an upward trend across all LDZs from Autumn 2019 (down from 163 to 35)

For the higher consumption bands and most WAR band analyses, demand modelling is done with data sets grouped across LDZs. In these circumstances, instances of multiple EUCs with increasing or decreasing patterns are down to the same underlying demand model and not due to multiple models showing a trend.

To reiterate, there are some instances of specific EUCs and specific LDZs, where a “down/down” pattern or an “up/up” pattern occurs to a notable extent over the three years. However, three data points do not necessarily point to a trend and examination of a fourth year of CWV intercept data reveals that these possible instances are not sustained. For the four most recent analysis years (2016/17, 2017/18, 2018/19 and 2019/20) CWV intercepts are available on a consistent basis. These may be categorised into four groups, namely: no consistent trend, increasing values, decreasing values and flat (or nearly flat) models. Summary results are presented as Table 3. These show that 362 out of 429 occurrences indicate no consistent trend.

For every LDZ over four years, the predominant effect is of no consistent pattern. In each LDZ 23 or more (of 33) EUCs show no consistent pattern over the four years. The number of EUCs with a consistent pattern (upwards or downwards) in any LDZ does not exceed 7 (of 33).

For the 2 EUCs that showed a majority of occurrences of a downward pattern in CWV intercepts over three years, the four year picture for these EUCs is one of no consistent trend. Over four years 6 EUCs of 429 (1.4% of EUCs) showed a consistently upward pattern, and 22 EUCs (5.1%) showed a consistently downward pattern.

5.0 Peak Load Factor Trends (Figure 10 to 18)

The final set of information to be considered as part of this analysis is presented in Figures 10 to 18. These show the Peak Load Factors for the individual years' models of the consumption band EUCs, over the four years available on a consistent basis.

These graphs of Peak Load Factors (Figures 10 to 18) show that there are zero instances of a year on year increase in Peak Load Factors in any of the consumption band EUCs that is consistently expressed across all of the LDZs. The graphs do show, however, instances of a small year on year increase in Peak Load Factors for 18 of the 117 consumption bands EUCs analysed. 3 of which relate to Small NDM EUCs – EA:E2004B, EM:E2004B, and NE:E2004B. As well as 15 which relate to Large NDM EUCs – SC:E2005B, EA:E2005B, SE:E2006B, EM:E2007B, WS:E2007B, NT:E2007B, SE:E2007B, SO:E2007B, SW:E2007B, EM:E2008B, WS:E2008B, NT:E2008B, SE:E2008B, SO:E2008B, and SW:E2008B

Overall the graphs confirm the evidence of the CWV intercept information previously presented, that the predominant effect is one of no consistent trend.

6.0 Conclusion

On the basis of this material, supported by the results of similar analysis undertaken in previous years and there being no signs of trends in the EUC demand models of sufficient clarity, Xoserve believe that the current averaging approach to model smoothing applied over three years continues to be appropriate and fit for purpose.

DESC will be consulted on this topic at a meeting on 24th February to seek their views.

FIGURES 1 TO 4: CWV INTERCEPT DIFFERENCES – PREDICTIVE ABILITY ANALYSIS

FIGURE 1: SMALL NDM CONSUMPTION BAND EUCs (<2,196 MWh p.a) - PREDICTIVE ABILITY:
Actual Model Intercept - Single Year Intercept **vs** Actual Model Intercept - Smoothed Year Model Intercept

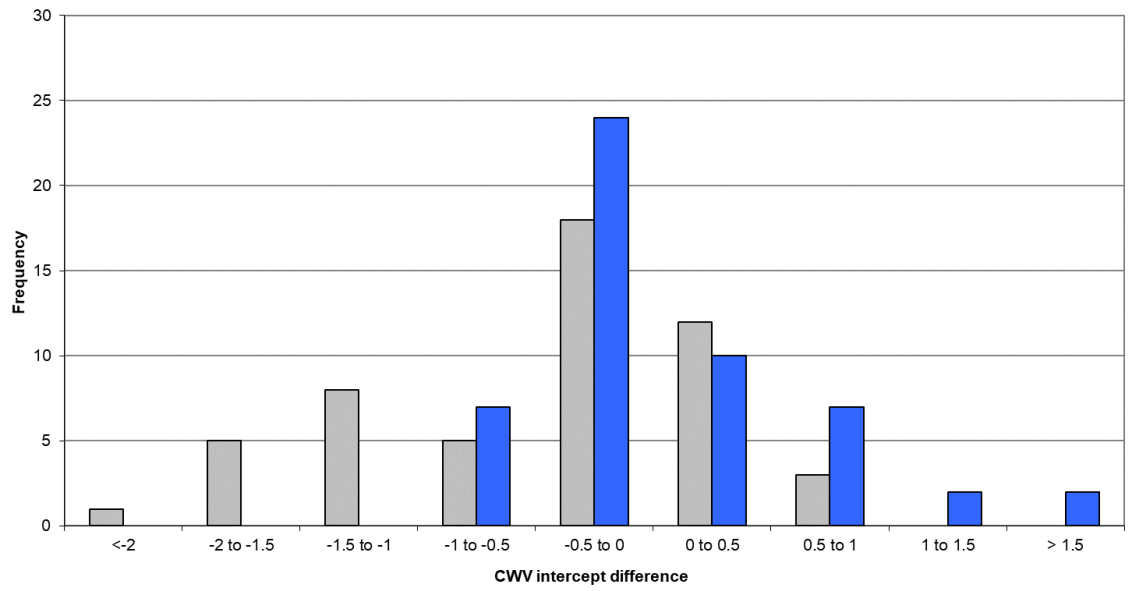
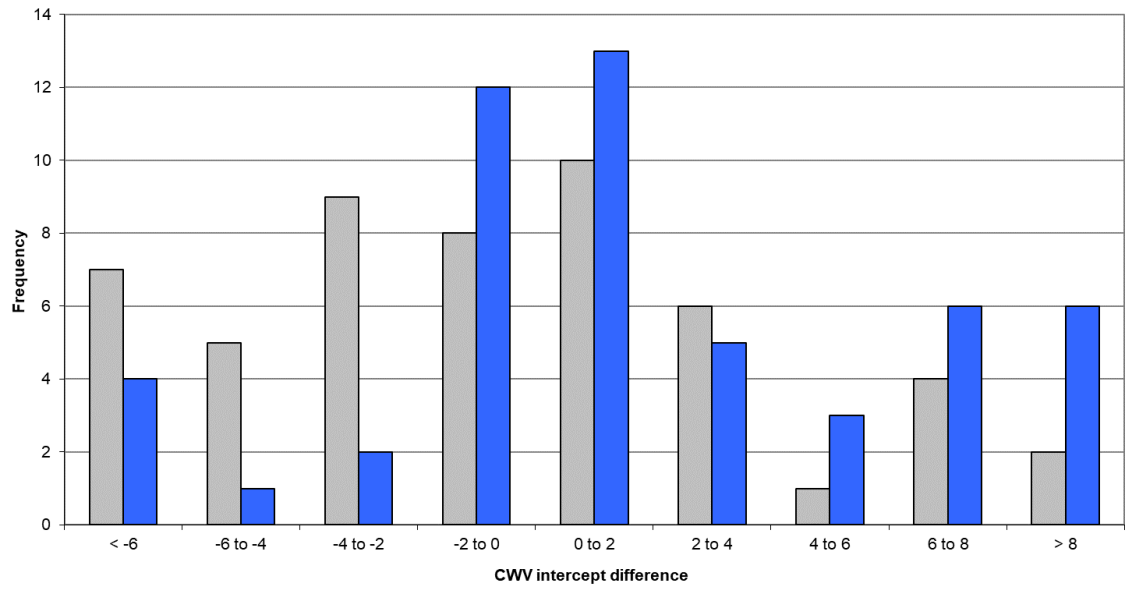


FIGURE 2: LARGE NDM CONSUMPTION BAND EUCs (>2,196 MWh p.a) - PREDICTIVE ABILITY:
Actual Model Intercept - Single Year Model Intercept **vs** Actual Model Intercept - Smoothed Year Model Intercept



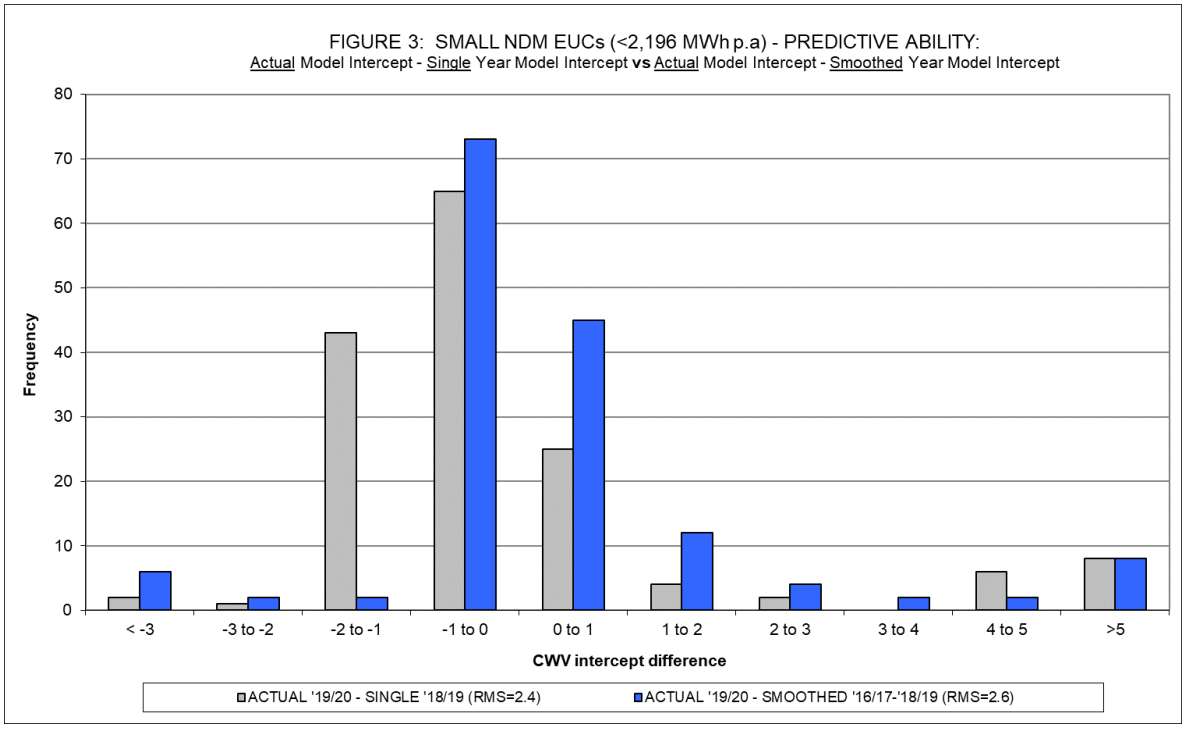


FIGURE 3: SMALL NDM EUCs (<2,196 MWh p.a) - PREDICTIVE ABILITY:
Actual Model Intercept - Single Year Model Intercept vs Actual Model Intercept - Smoothed Year Model Intercept
Frequency
0
10
20
30
40
50
60
70
80
< -3
-3 to -2
-2 to -1
-1 to 0
0 to 1
1 to 2
2 to 3
3 to 4
4 to 5
>5
CWV intercept difference
ACTUAL '19/20 - SINGLE '18/19 (RMS=2.4)
ACTUAL '19/20 - SMOOTHED '16/17-'18/19 (RMS=2.6)

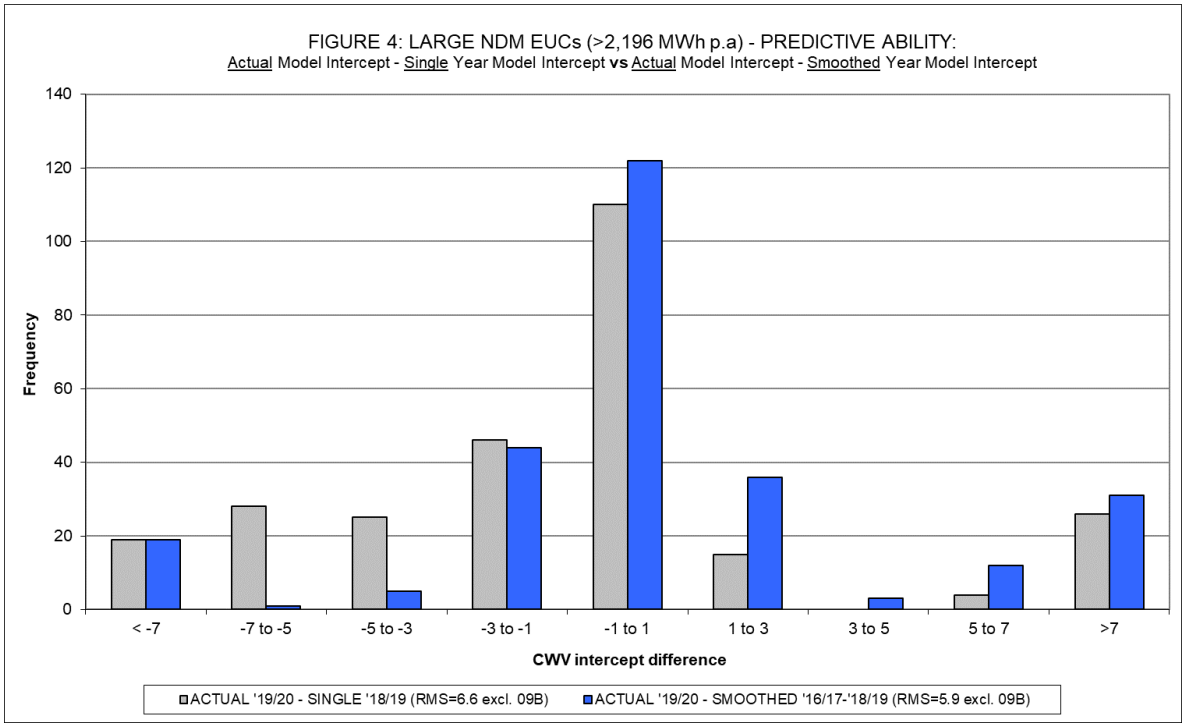


FIGURE 4: LARGE NDM EUCs (>2,196 MWh p.a) - PREDICTIVE ABILITY:
Actual Model Intercept - Single Year Model Intercept vs Actual Model Intercept - Smoothed Year Model Intercept
Frequency
0
20
40
60
80
100
120
140
< -7
-7 to -5
-5 to -3
-3 to -1
-1 to 1
1 to 3
3 to 5
5 to 7
>7
CWV intercept difference
ACTUAL '19/20 - SINGLE '18/19 (RMS=6.6 excl. 09B)
ACTUAL '19/20 - SMOOTHED '16/17-'18/19 (RMS=5.9 excl. 09B)

FIGURES 5 TO 8: CWV INTERCEPT DIFFERENCES – VOLATIITY ANALYSIS

FIGURE 5: SMALL NDM EUCs (<2,196 MWh p.a) - YEAR ON YEAR VOLATILITY
Single Year Model Comparisons **vs** Smoothed Year Model Comparisons

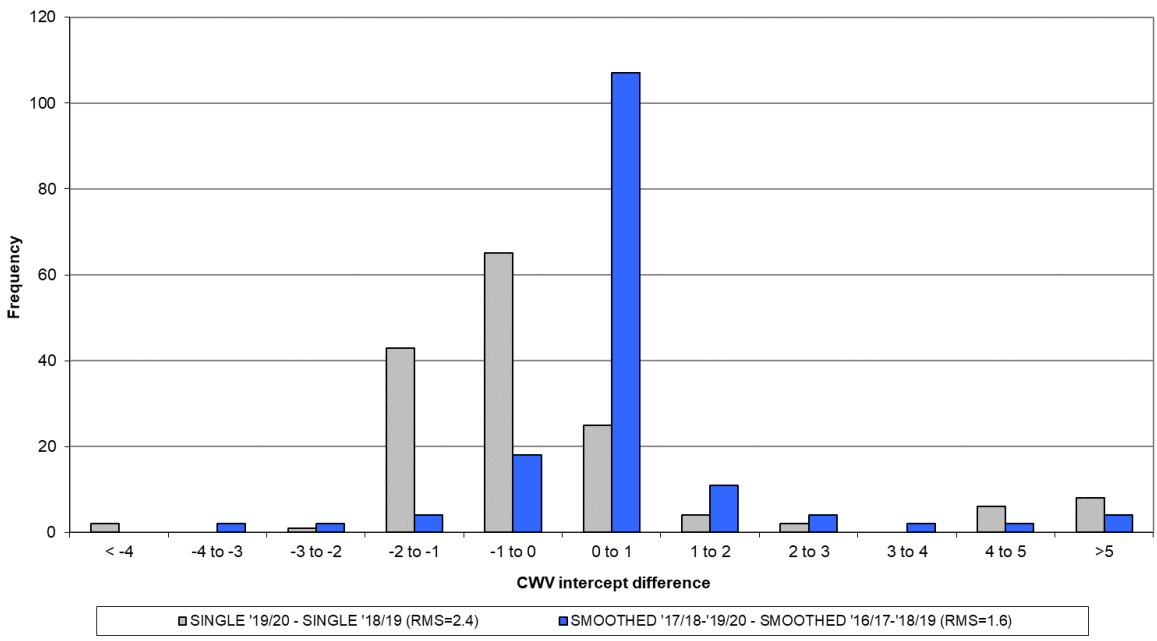


FIGURE 6: LARGE NDM EUCs (>2,196 MWh p.a) - YEAR ON YEAR VOLATILITY
Single Year Model Comparisons **vs** Smoothed Year Model Comparisons

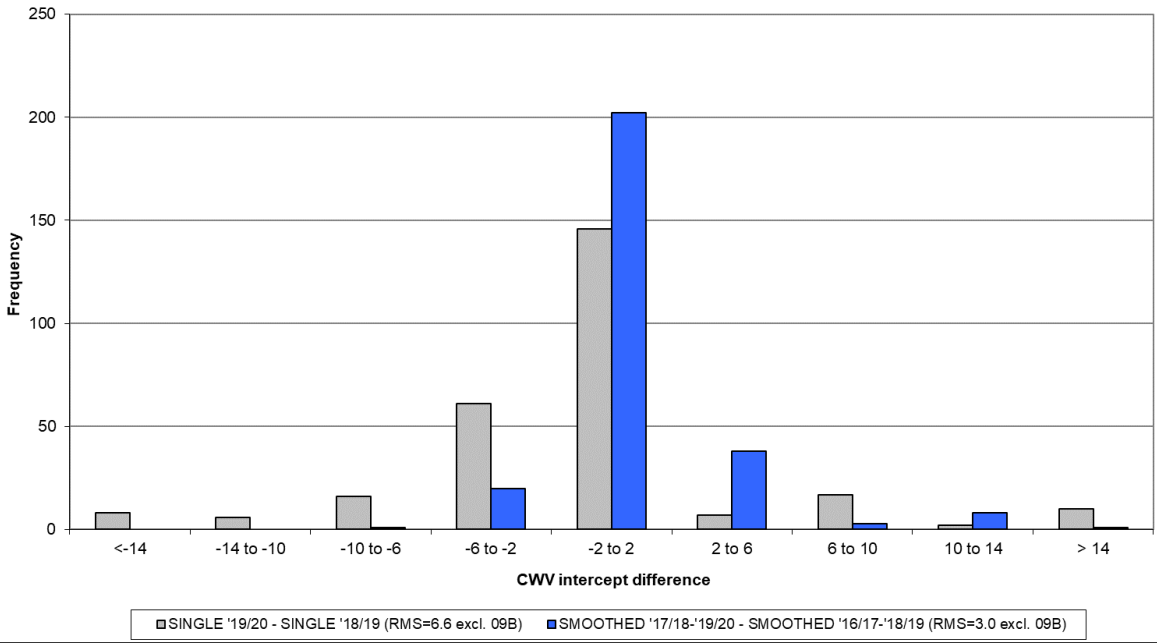


FIGURE 7: SMALL NDM CONSUMPTION BAND EUCs (<2,196 MWh p.a) - YEAR ON YEAR VOLATILITY
Single Year Model Comparisons **vs** Smoothed Year Model Comparisons

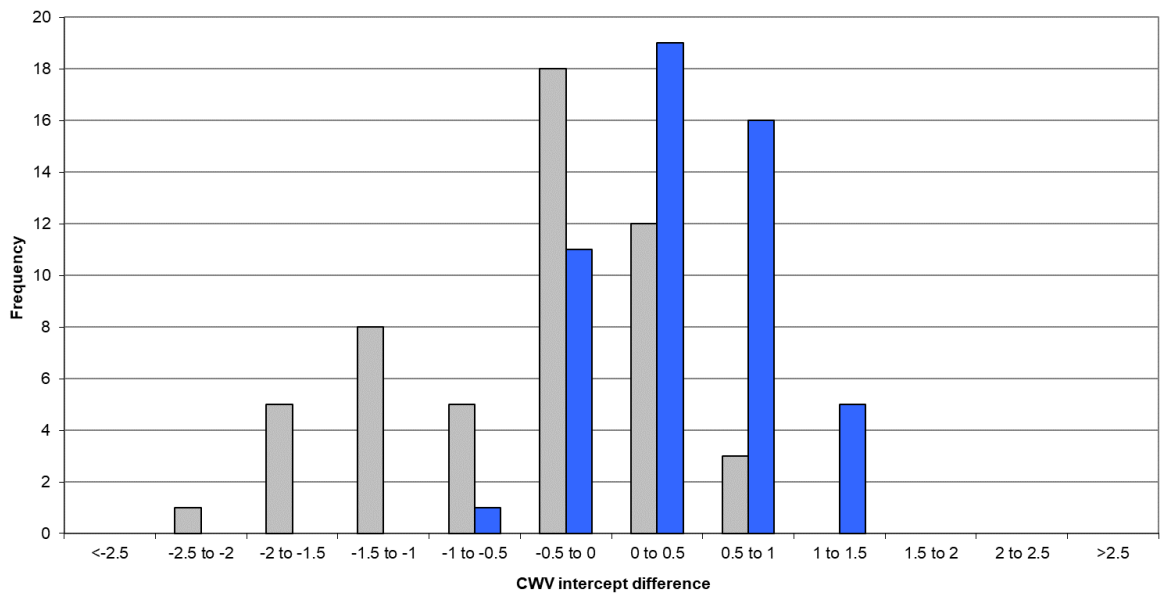


FIGURE 8: LARGE NDM CONSUMPTION BAND EUCs (>2,196 MWh p.a) - YEAR ON YEAR VOLATILITY
Single Year Model Comparisons **vs** Smoothed Year Model Comparisons

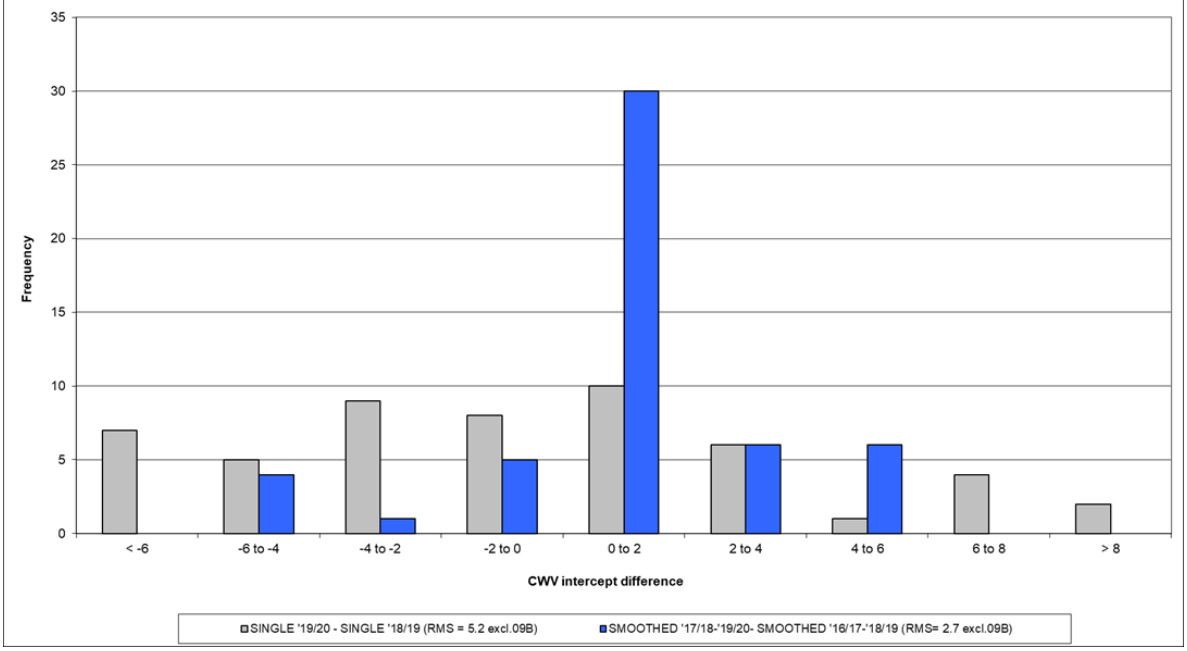


FIGURE 9: KEY FOR CWV INTERCEPT PATTERN TYPES: 3 YEARS OF NDM DEMAND MODELS

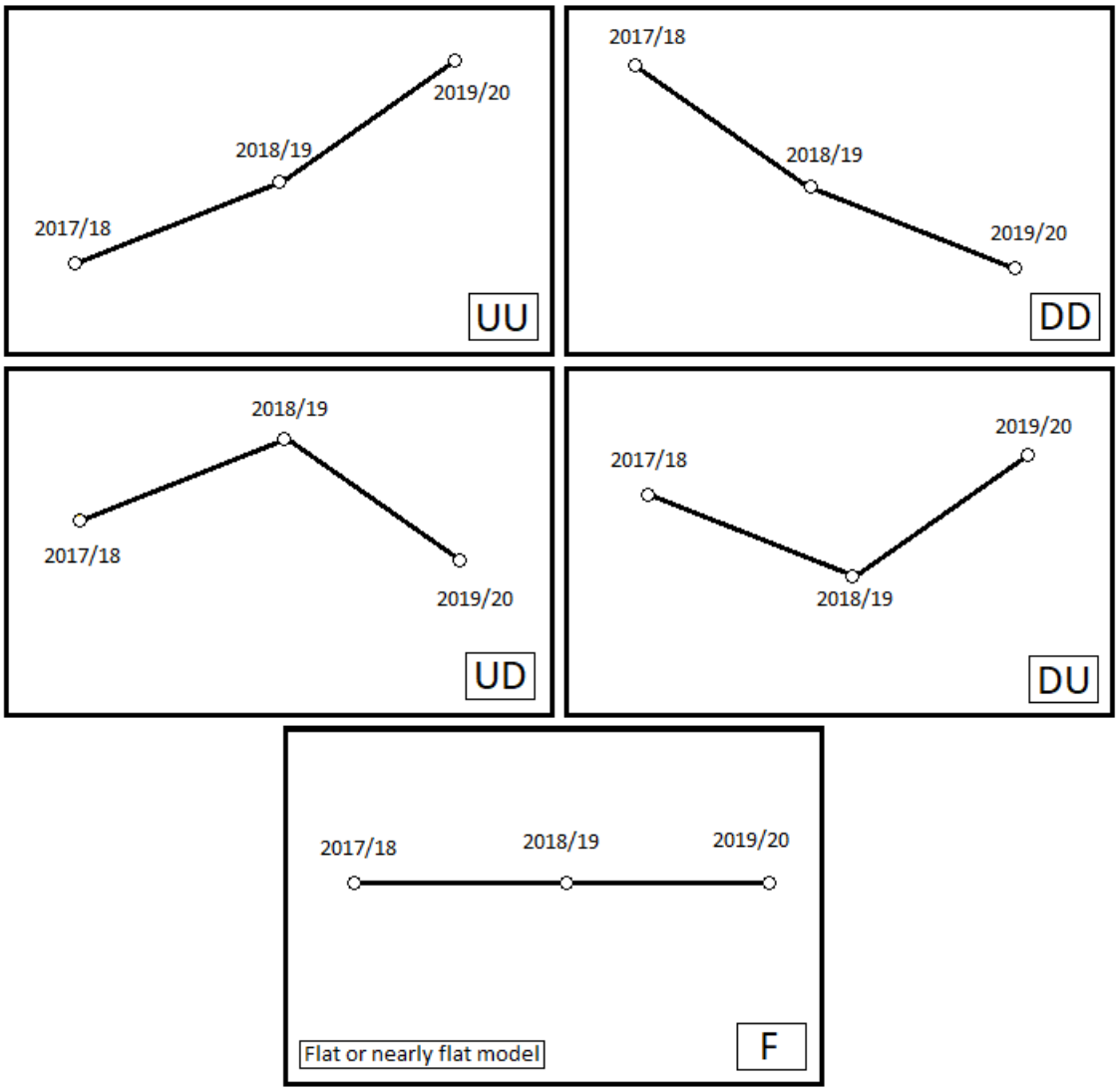


TABLE 1: CWV INTERCEPT PATTERNS
NDM DEMAND MODELS FOR 2017/18, 2018/19, 2019/20

Consumption Band EUCs

xx = LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E2001BND	DD	DD	DU	DU	DD	DD	DU	DU	DU	DU	DD	DD	UU
xx:E2002BNI	DD	DU	DD	DD	DD	DU	DU	DD	DU	DU	DD	DD	DD
xx:E2003B	UD	UD	DD	DD	UD	UD	DD	UD	UD	DD	DD	UD	UU
xx:E2004B	DD	DD	UD	UD	UU	UD	UD	UD	UU	UD	UD	UD	DD
xx:E2005B	UU	UD	DD	DD	UD	UU	DD	DU	UD	DU	DU	UD	DU
xx:E2006B	UD	UD	UD	DU	DU	DD	UD	DD	DU	DD	UU	DU	UD
xx:E2007B	UD	UU	UD	UD	UU	DD	UD	UU	DU	UD	DU	DU	UD
xx:E2008B	UD	UU	UD	UD	UU	DD	UD	UU	DU	UD	DU	DU	UD
xx:E2009B	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

First (i.e. Flattest, W01) WAR Bands in each Consumption Range

xx = LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E2003W01	DU	DU	DU	DU	UU	DU	DU	DU	DD	DD	UD	DU	DU
xx:E2004W01	DU	DU	DU	DU	UU	DU	DU	DU	DD	DD	UD	DU	DU
xx:E2005W01	DU	DD	DD	DU	DU	DU	DD	UU	DU	DU	DU	UU	UU
xx:E2006W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E2007W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E2008W01	F	F	F	F	F	F	F	F	F	F	F	F	F

Second (i.e. W02) WAR Bands in each Consumption Range

xx = LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E2003W02	DD	UD	UD	DU	UU	DD	UD	DD	DU	DD	UD	UD	UU
xx:E2004W02	DD	UD	UD	DU	UU	DD	UD	DD	DU	DD	UD	UD	UU
xx:E2005W02	UD	DU	DU	UU	UU	UU	DU	UU	UD	UD	UD	UD	UD
xx:E2006W02	UD	UD	UD	DD	DD	DD	UD	DD	DD	DD	DD	DD	DD
xx:E2007W02	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
xx:E2008W02	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD

Third (i.e. W03) WAR Bands in each Consumption Range

xx = LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E2003W03	DD	DD	UD	DU	UD	DD	UD	UD	UD	UD	UD	UD	UD
xx:E2004W03	DD	DD	UD	DU	UD	DD	UD	UD	UD	UD	UD	UD	UD
xx:E2005W03	UU	UU	DU	DU	DU	DU	DU	DU	UU	UU	UU	UD	UU
xx:E2006W03	DU	DU	DU	DD	DD	DD	DU	UD	UD	UD	UD	UD	UU
xx:E2007W03	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
xx:E2008W03	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD

Fourth (i.e. Peakiest, W04) WAR Bands in each Consumption Range

xx = LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E2003W04	UD	DD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
xx:E2004W04	UD	DD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
xx:E2005W04	UU	UD	DD	UD	UD	UD	DD	UD	UD	UD	UD	UD	UD
xx:E2006W04	DU	DU	DU	UD	UD	UD	DU	DU	UD	UD	UD	UD	UU
xx:E2007W04	DD	DD	DD	UD	UD	UD	DD	UD	UD	UD	UD	UD	UD
xx:E2008W04	DD	DD	DD	UD	UD	UD	DD	UD	UD	UD	UD	UD	UD

TABLE 2: CWV INTERCEPT PATTERNS: NDM DEMAND MODELS FOR 2017/18, 2018/19 AND 2019/20
COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type					Total
	UU	UD	DU	DD	F	
xx:E2001BND	1	0	6	6	0	13
xx:E2002BNI	0	0	5	8	0	13
xx:E2003B	1	7	0	5	0	13
xx:E2003W01	1	1	9	2	0	13
xx:E2003W02	2	5	2	4	0	13
xx:E2003W03	0	9	1	3	0	13
xx:E2003W04	0	12	0	1	0	13
xx:E2004B	2	8	0	3	0	13
xx:E2004W01	1	1	9	2	0	13
xx:E2004W02	2	5	2	4	0	13
xx:E2004W03	0	9	1	3	0	13
xx:E2004W04	0	12	0	1	0	13
xx:E2005B	2	4	4	3	0	13
xx:E2005W01	3	0	7	3	0	13
xx:E2005W02	4	6	3	0	0	13
xx:E2005W03	6	1	6	0	0	13
xx:E2005W04	1	10	0	2	0	13
xx:E2006B	1	5	4	3	0	13
xx:E2006W01	0	0	0	0	13	13
xx:E2006W02	0	4	0	9	0	13
xx:E2006W03	1	5	4	3	0	13
xx:E2006W04	1	7	5	0	0	13
xx:E2007B	3	6	3	1	0	13
xx:E2007W01	0	0	0	0	13	13
xx:E2007W02	0	13	0	0	0	13
xx:E2007W03	0	13	0	0	0	13
xx:E2007W04	0	9	0	4	0	13
xx:E2008B	3	6	3	1	0	13
xx:E2008W01	0	0	0	0	13	13
xx:E2008W02	0	13	0	0	0	13
xx:E2008W03	0	13	0	0	0	13
xx:E2008W04	0	9	0	4	0	13
xx:E2009B	0	0	13	0	0	13
Total by Type	35	193	87	75	39	429

Autumn 2020

16/17, '17/18, & '18/19 Analysis Years	163	155	59	13	39	429

Autumn 2019

KEY	
UU	Increasing Trend
UD	Increasing then Decreasing Trend
DU	Decreasing then Increasing Trend
DD	Decreasing Trend
F	Flat Model

LDZ	Type					Total
	UU	UD	DU	DD	F	
SC	3	12	6	9	3	33
NO	3	11	7	9	3	33
NW	0	15	8	7	3	33
NE	1	13	11	5	3	33
EM	8	14	4	4	3	33
WM	2	12	6	10	3	33
WN	0	15	9	6	3	33
WS	4	14	7	5	3	33
EA	2	16	9	3	3	33
NT	1	17	5	7	3	33
SE	2	19	5	4	3	33
SO	1	20	6	3	3	33
SW	8	15	4	3	3	33
Totals	35	193	87	75	39	429

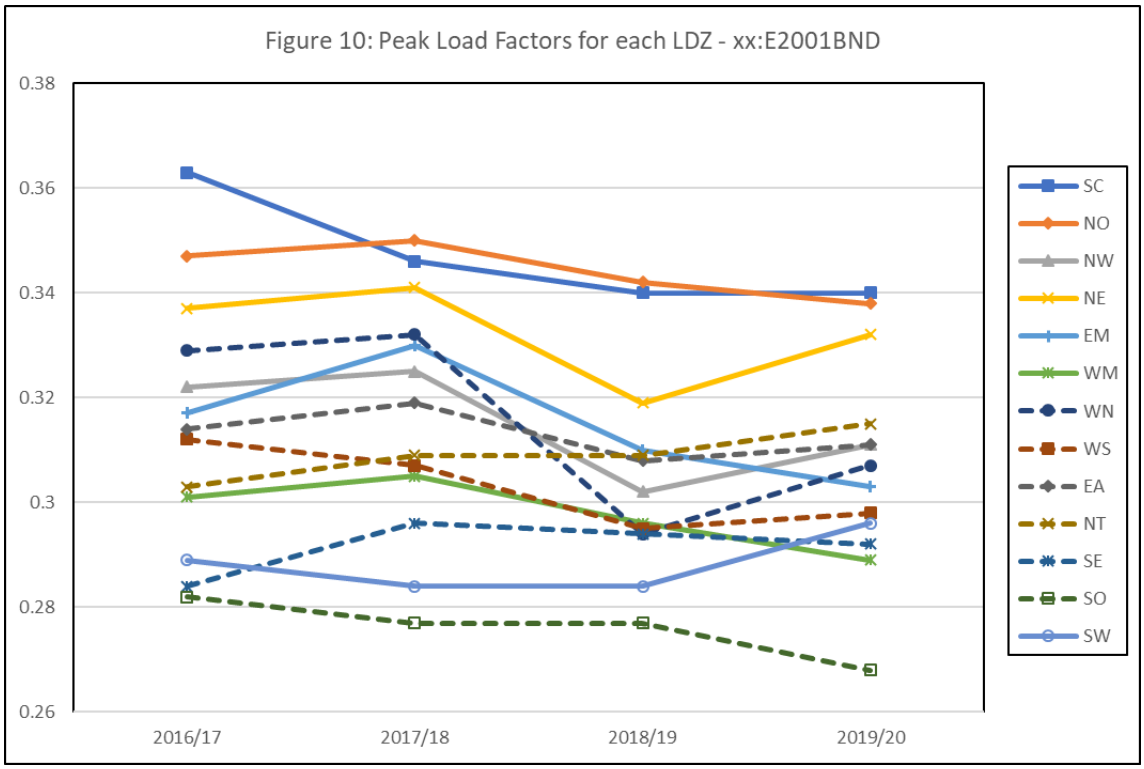
TABLE 3: CWV INTERCEPT PATTERNS: NDM DEMAND MODELS FOR 2016/17, 2017/18, 2018/19 AND 2019/20 COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

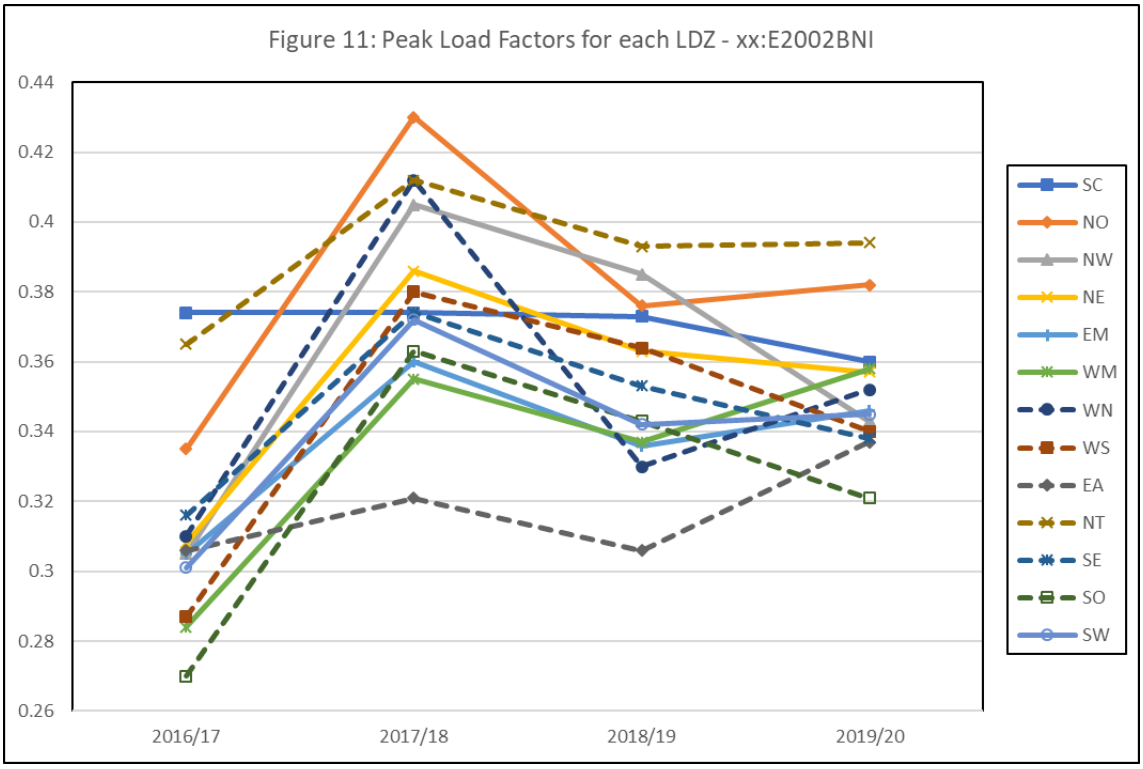
EUC	Type				Total
	N	D	U	F	
xx:E1901BND	9	3	1	0	13
xx:E1902BNI	13	0	0	0	13
xx:E1903B	12	0	1	0	13
xx:E1903W01	12	0	1	0	13
xx:E1903W02	11	0	2	0	13
xx:E1903W03	13	0	0	0	13
xx:E1903W04	13	0	0	0	13
xx:E1904B	11	0	2	0	13
xx:E1904W01	12	0	1	0	13
xx:E1904W02	11	0	2	0	13
xx:E1904W03	13	0	0	0	13
xx:E1904W04	13	0	0	0	13
xx:E1905B	12	0	1	0	13
xx:E1905W01	13	0	0	0	13
xx:E1905W02	13	0	0	0	13
xx:E1905W03	7	0	6	0	13
xx:E1905W04	12	0	1	0	13
xx:E1906B	11	1	1	0	13
xx:E1906W01	0	0	0	13	13
xx:E1906W02	13	0	0	0	13
xx:E1906W03	13	0	0	0	13
xx:E1906W04	12	0	1	0	13
xx:E1907B	11	1	1	0	13
xx:E1907W01	0	0	0	13	13
xx:E1907W02	13	0	0	0	13
xx:E1907W03	13	0	0	0	13
xx:E1907W04	13	0	0	0	13
xx:E1908B	11	1	1	0	13
xx:E1908W01	0	0	0	13	13
xx:E1908W02	13	0	0	0	13
xx:E1908W03	13	0	0	0	13
xx:E1908W04	13	0	0	0	13
xx:E1909B	13	0	0	0	13
Total by Type	362	6	22	39	429

KEY	
UU	Increasing Trend
UD	Increasing then Decreasing Trend
DU	Decreasing then Increasing Trend
DD	Decreasing Trend
F	Flat Model

EUC	Type				Total
	N	D	U	F	
SC	27	1	2	3	33
NO	28	1	1	3	33
NW	30	0	0	3	33
NE	30	0	0	3	33
EM	23	0	7	3	33
WM	27	2	1	3	33
WN	30	0	0	3	33
WS	29	1	0	3	33
EA	28	0	2	3	33
NT	29	0	1	3	33
SE	28	0	2	3	33
SO	29	1	0	3	33
SW	24	0	6	3	33
Totals	362	6	22	39	429

FIGURES 10 to 18: PEAK LOAD FACTORS FROM INDIVIDUAL YEAR MODELS OVER 4 YEARS AVAILABLE 2016/17, 2017/18, 2018/19 AND 2019/20





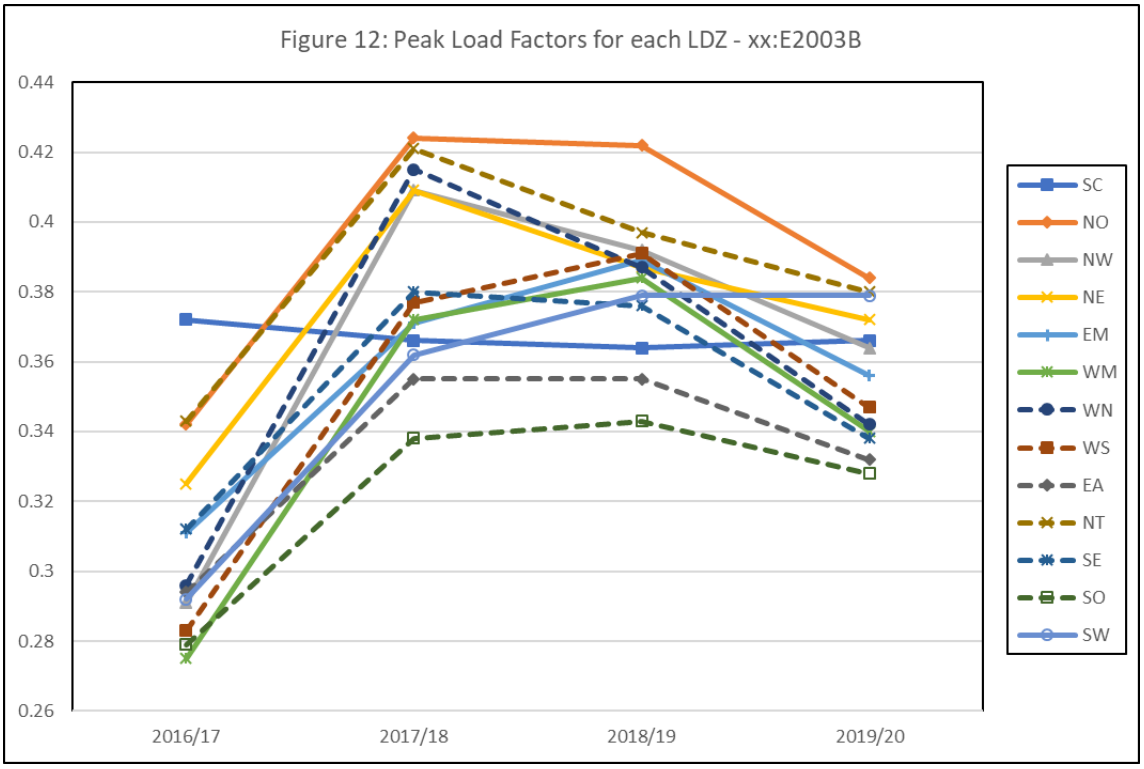


Figure 12: Peak Load Factors for each LDZ - xx:E2003B
0.44
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
2016/17
2017/18
2018/19
2019/20
SC
NO
NW
NE
EM
WM
WN
WS
EA
NT
SE
SO
SW

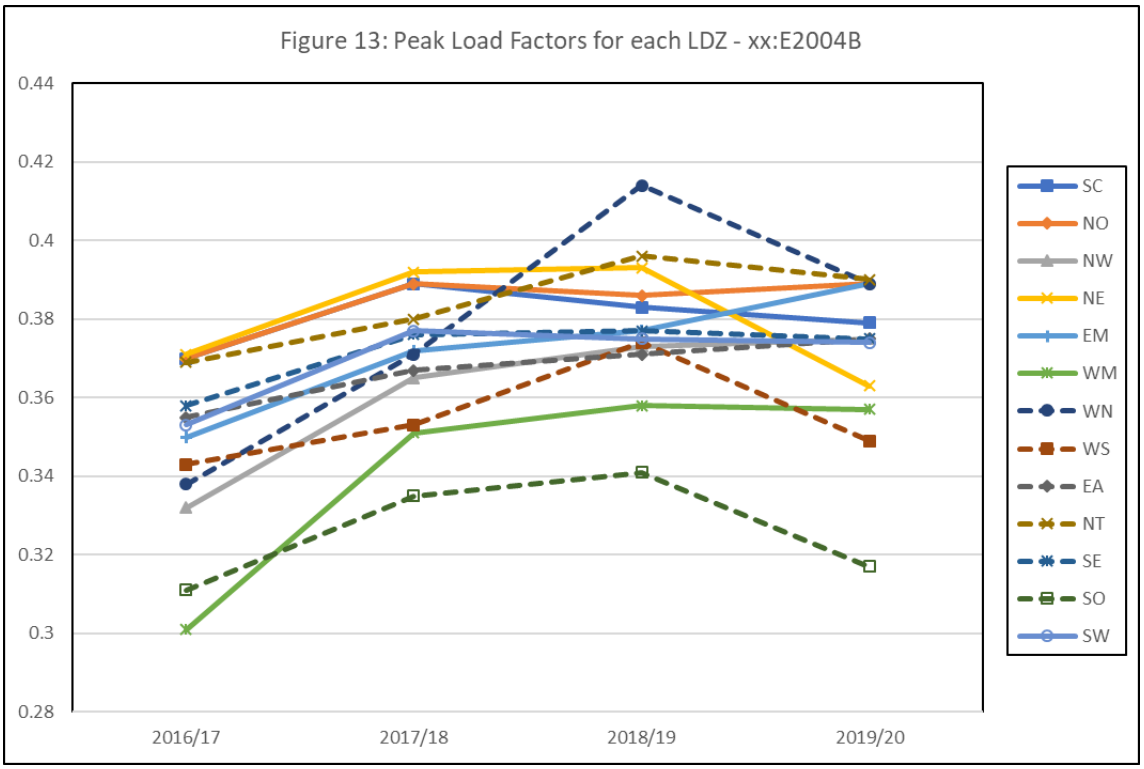


Figure 13: Peak Load Factors for each LDZ - xx:E2004B
0.44
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
2016/17
2017/18
2018/19
2019/20
SC
NO
NW
NE
EM
WM
WN
WS
EA
NT
SE
SO
SW

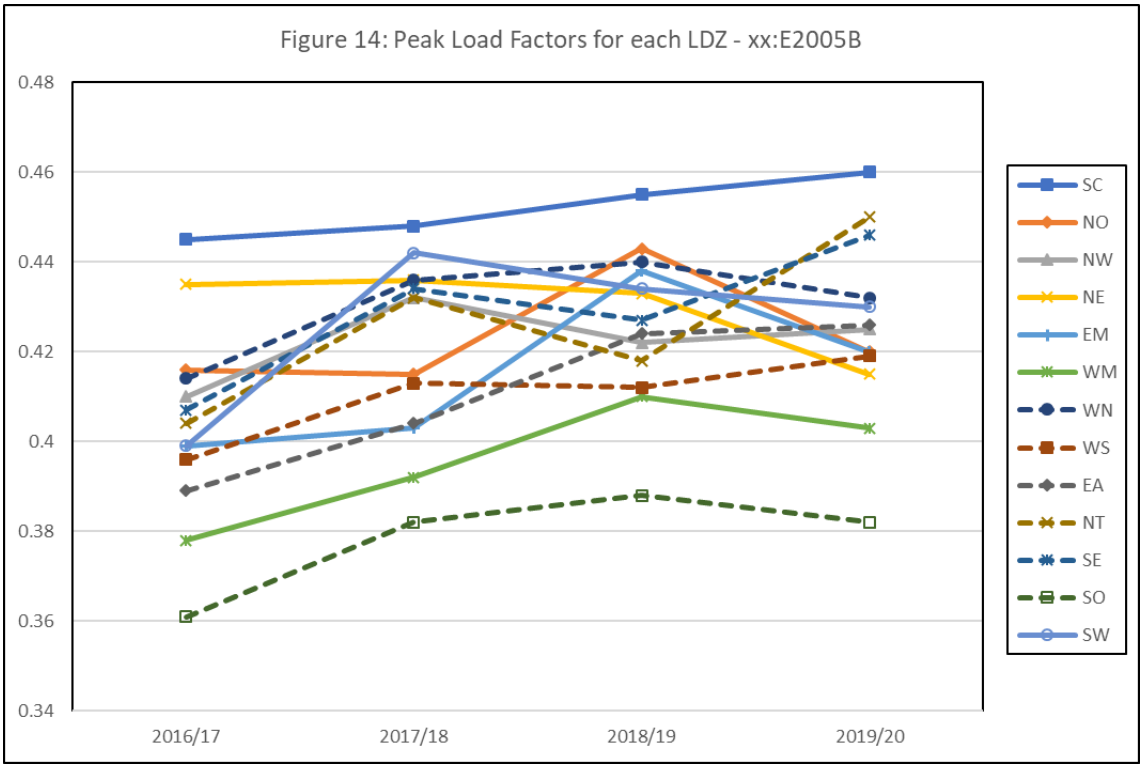


Figure 14: Peak Load Factors for each LDZ - xx:E2005B
0.48
0.46
0.44
0.42
0.4
0.38
0.36
0.34
2016/17
2017/18
2018/19
2019/20
SC
NO
NW
NE
EM
WM
WN
WS
EA
NT
SE
SO
SW

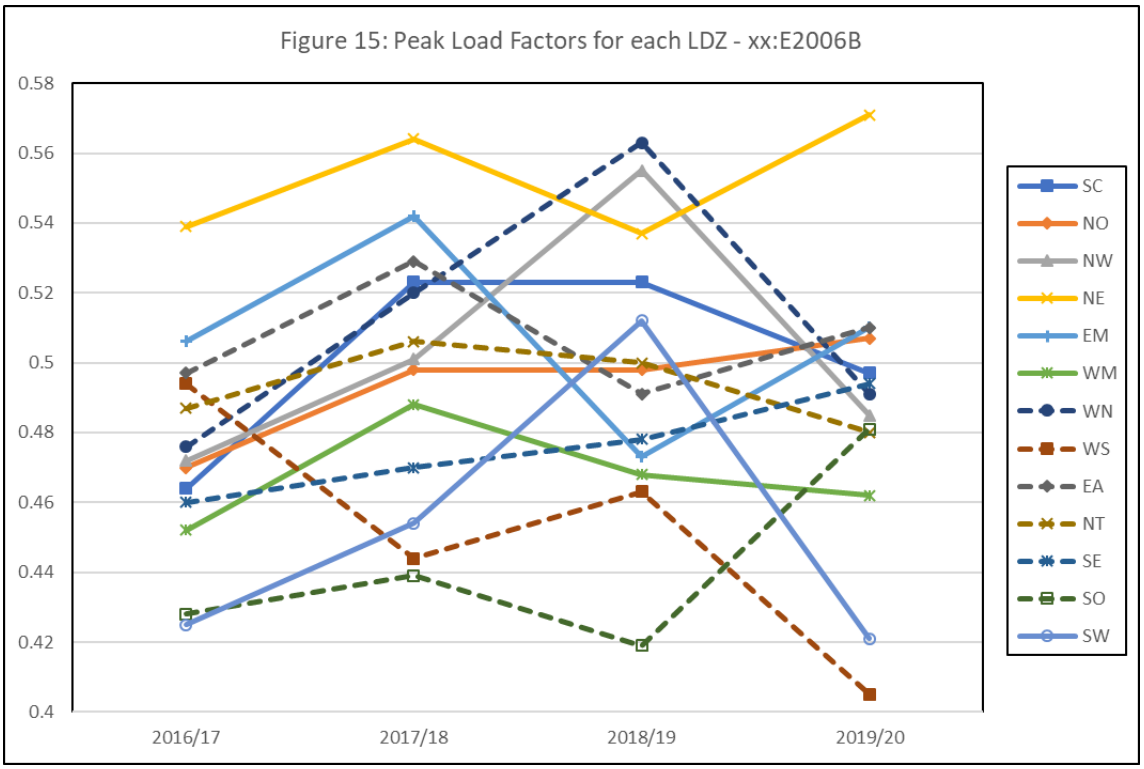


Figure 15: Peak Load Factors for each LDZ - xx:E2006B
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
2016/17
2017/18
2018/19
2019/20
SC
NO
NW
NE
EM
WM
WN
WS
EA
NT
SE
SO
SW

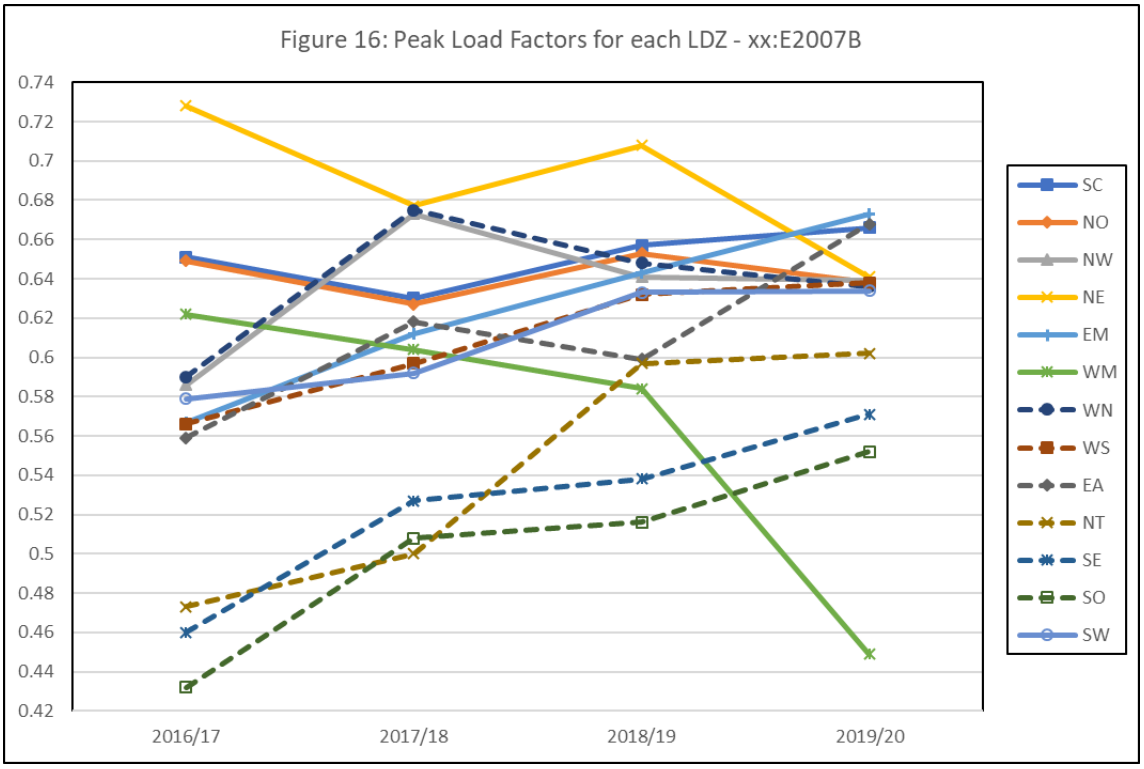


Figure 16: Peak Load Factors for each LDZ - xx:E2007B
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
2016/17
2017/18
2018/19
2019/20
SC
NO
NW
NE
EM
WM
WN
WS
EA
NT
SE
SO
SW

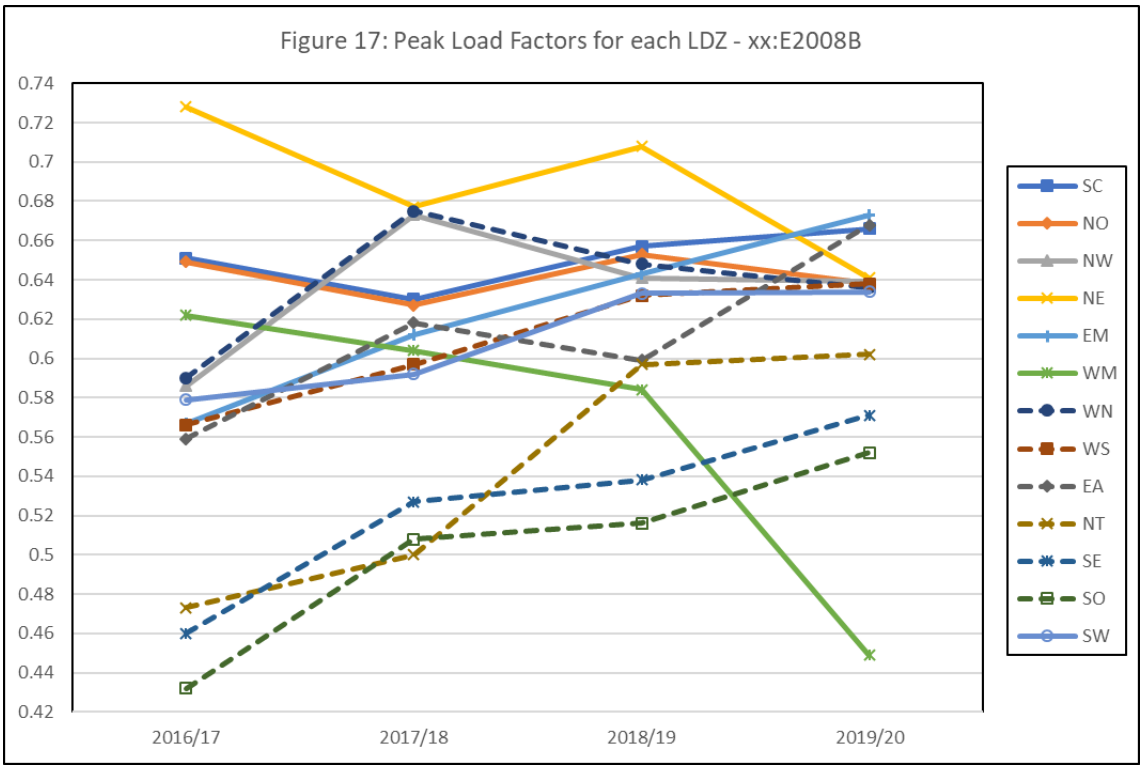
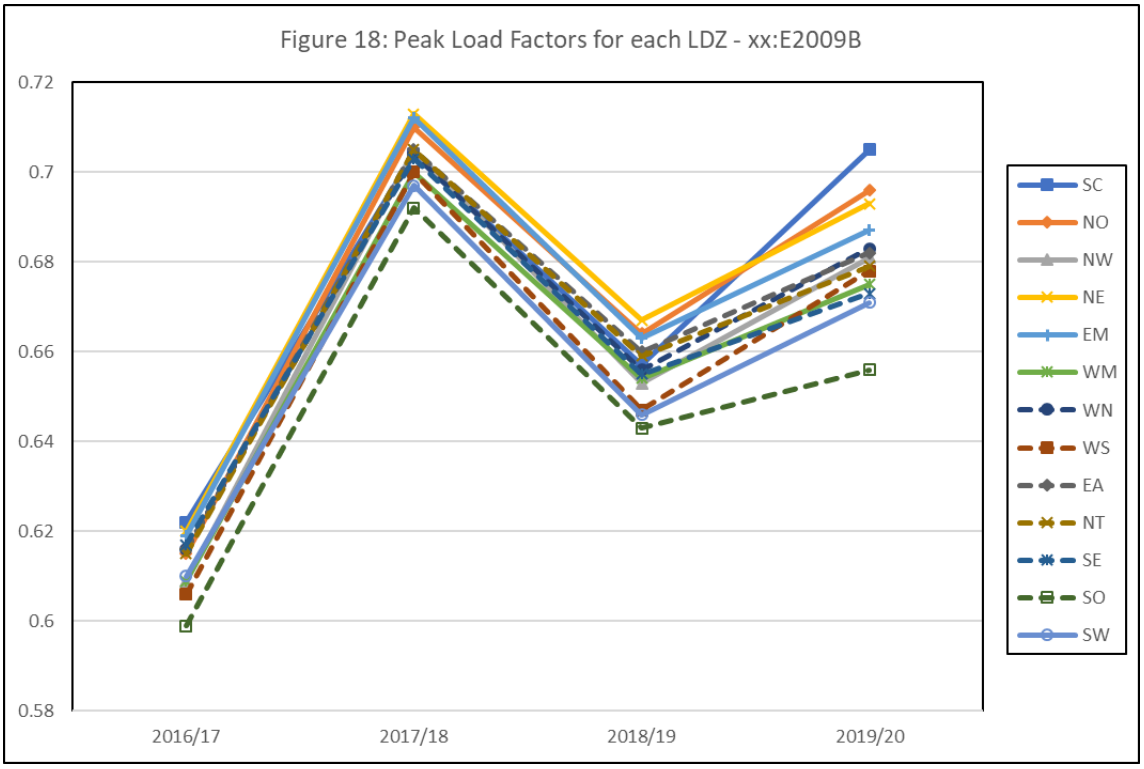


Figure 17: Peak Load Factors for each LDZ - xx:E2008B
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
2016/17
2017/18
2018/19
2019/20
SC
NO
NW
NE
EM
WM
WN
WS
EA
NT
SE
SO
SW



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