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 2011/12.

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 2009. Following discussion of those results at DESC in November 2009, it was decided to continue to apply model smoothing in deriving the NDM proposals for 2010/11 and 2011/12.

The proposals for 2011/12 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.

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

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) 2010/11 consumption data with:

- the 2009/10 (single year) models
- the smoothed models based on 2007/08, 2008/09 and 2009/10 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 2007/08, 2008/09 and 2009/10 along with those for 2010/11, provide the necessary information. All of these CWV intercepts relate to models derived using the current definitions of CWVs and the current basis for SNCWVs that were used in the spring 2010 and 2011 NDM analyses and came into effect on 1st October 2010. 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 Consumption Band Analysis (Figures 1 & 2)

The bar charts attached as Figures 1 and 2 show, 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 2010/11 (based on 2007/08, 2008/09 and 2009/10 data) shows a slight degradation, in terms of the spread of CWV intercept differences, over that for the single year (2009/10) model, and this is also reflected in the respective RMS values, which are worse for the smoothed model. For large NDM consumption band EUCs (Figure 2) the RMS value is better for the smoothed model both including and excluding the contribution of band 09B. So, on balance, the picture is mixed for small and large NDM consumption band EUCs, the smoothed three-year model is better at predicting 2010/11 than the single year, 2009/10 model for large NDM "B" EUCs and worse for small NDM "B" EUCs.

3.2 WAR Band Analysis (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) shows a slight improvement for the smoothed model case compared to the single year model case, and the RMS value (which indicates the spread of CWV intercept differences around zero) is lower for the smoothed model.

For all large NDM EUCs (Figure 4) the spread of CWV intercept differences shows a slight degradation for the smoothed model case compared to the single year model case. For all large NDM EUCs, the relevant RMS values (both including and excluding band 09B) are higher for the smoothed model.

This analysis of "predictive ability", undertaken on the same basis as previous years, has yielded mixed results: there are signs of an improvement in "predictive ability" with the smoothed model for large NDM consumption band only EUCs and all small NDM EUCs and a degradation in "predictive ability" for small NDM consumption band only EUCs and all large NDM EUCs. Overall, there is no strong evidence that either smoothed models or single year models are consistently better in terms of predictive ability.

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)

Consequently, 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 2010/11 (based on 2007/08, 2008/09 and 2009/10) and the smoothed models applicable to gas year 2011/12 (based on 2008/09, 2009/10 and 2010/11)

- Difference in CWV intercepts between individual year models for 2009/10 and 2010/11 that would have been applied to gas years 2010/11 and 2011/12 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 as shown by both the generally narrower distribution of CWV intercept differences and generally notable reductions in the corresponding RMS values.

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 2009). 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.

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 2011/12 - 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 2008/09, 2009/10 and 2010/11, the overall count of the different pattern types indicates that:

- The "down/up", pattern shows 161 occurrences out of 429 (there were 91 in 2010, 101 in 2009, 173 in 2008 and 68 in 2007).
- The “up/down” pattern shows 85 occurrences (there were 214 in 2010, 123 in 2009, 81 in 2008 and 195 in 2007).
- Thus, taken together, 246 occurrences (305 in 2010, 224 in 2009, 254 in 2008 and 263 in 2007) have no increasing or decreasing pattern over the three years.
- This year also shows 39 flat or nearly flat models (the same numbers as in 2010, 2009, 2008 and 2007).

The prevalence of “down/up” and up/down” patterns (246) remains greater than half of the number of cases (429), Since there are 39 cases of flat or nearly flat models (all of which are EUCs applicable to WAR band 1) 246 of 390 remaining cases show no consistent pattern over three years. Instances with a decreasing pattern number 54 (33 in 2010, 37 in 2009, 90 in 2008 and 99 in 2007) and instances of an increasing pattern over three years amount to 90 (52 in 2010, 129 in 2009, 46 in 2008 and 28 in 2007).

The three instances of EUCs where there is an increasing pattern over three years in a majority of LDZs (i.e. 7 or more of 13) are all in the WAR band EUCs. The two instances of EUCs where there is a decreasing pattern over three years in a majority of LDZs are also WAR band EUCs. SC LDZ shows an increasing pattern in 17 EUCs, but there are no other instances of LDZs where there is an

increasing (or decreasing) pattern over three years in a majority of EUCs (there are 33 EUCs in each LDZ). 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 (2007/08, 2008/09, 2009/10 and 2010/11) 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 363 out of 429 occurrences (there were 364 in 2010, 356 in 2009, 352 in 2008 and 353 in 2007) indicate no consistent trend while the numbers of consistently decreasing or consistently increasing occurrences are now small (5 and 22 respectively this year – 6 and 20 respectively in 2010, 18 and 16 respectively in 2009, 25 and 13 respectively in 2008 and 19 and 19 respectively in 2007). Although a full model smoothing investigation was not undertaken in 2008 and 2010, these relevant counts were derived for use in this assessment.

The count of EUCs of no consistent pattern (363) is very similar to that of all previous assessments - the lowest observed was 348 in 2001. As Table 3 shows, the results for all previous model smoothing investigations have been very similar. The vast majority of cases are always that of no consistent trend. Furthermore, in all these investigations, the occurrences of consistent trends have been very much smaller than might be expected on purely random grounds.

For every LDZ over four years, the predominant effect is of no consistent pattern. In each LDZ 25 or more (of 33) EUCs shown no consistent pattern over the four years. The number of EUCs with a consistent pattern (upwards or downwards) in any LDZ does not exceed 4 (of 33).

For the three WAR band EUCs that showed a majority of occurrences of an upward pattern in CWV intercepts over three years, the four year picture for two of these EUCs is one of no consistent trend. Over four years only 22 EUCs of 429 showed a consistently upward pattern.

In particular, for EUCs xx:E1107W02, xx:E1107W03 and xx:E1108W03 all 13 LDZs in each case showed an upward trend over three years. In these three EUCs, demand modelling was undertaken with a national data set, and thus, these 13, 13 and 13 EUCs were derived from one single data aggregation in each case. Overall across all LDZs the equivalent EUCs (xx:E1007W02, xx:E1007W03 and xx:E1008W03 as of April 2011) constituted only 0.0003%, 0.0005% and 0.0001% of supply point numbers and 0.48%, 0.28% and 0.13% of overall NDM load (AQ basis) respectively. For EUCs xx:E1107W02 and xx:E1107W03, no LDZs showed an upward pattern over four years.

In EUC xx:E1108W03 there were 7 LDZs (out of 13) with an upward trend over four years. Due to sample size limitations, EUC demand modelling is often undertaken with data grouped across LDZs, and thus, these 7 EUCs were derived from just one distinct data aggregation in each year. Overall across the 7 LDZs the equivalent EUC (xx:E1008W03 as of April 2011) constituted only 0.00004% of supply point numbers and constituted 0.07% of overall NDM load (AQ basis). Examination of the load factors for individual year models over four years for this EUC (see Figure 19) showed that none of the six instances with an upward trend in CWV intercepts (in LDZs: NW, WN, EA, NT, SE, SO and SW) showed a similar upward trend in load factors and no other LDZs showed an increasing pattern of load factors.

For the two WAR band 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 in 12 out of 13 LDZs. Over four years only 5 EUCs of 429 showed a consistently downward pattern.

In particular, for EUCs xx:E1103W04 and xx:E1104W04, 7 LDZs in each case showed a downward trend over three years. In these two EUCs, demand modelling was undertaken on an individual LDZ basis (with NW / WN combined in all years and WS / SW combined in 2011) across both bands (03 and 04) and thus these 7 and 7 EUCs were derived from five or six distinct data aggregations in each

year. Overall across all LDZs the equivalent EUCs (xx:E1003W04 and xx:E1004W04 as of April 2011) constituted 0.02% and 0.01% of supply point numbers and 0.40% and 0.45% of overall NDM load (AQ basis) respectively. Only EUCs SW:E1103W04 and SW:E1104W04 EUCs (both derived from the same data aggregations) showed a downward pattern over four years.

5.0 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 load factors for the individual years' models of the consumption band EUCs, over the four years available on a consistent basis.

These graphs of load factors (Figures 10 to 18) confirm the evidence of the CWV intercept information previously presented: there are no instances of a year on year increase or decrease in load factors in any of the consumption band EUCs that are consistently expressed across all of the LDZs.

6.0 Conclusion

It is the collective view of Transporters, on the basis of this material, supported also by the results of this same analysis undertaken in 2009 and in previous years, that there are no signs of trends in the EUC demand models of sufficient clarity to influence the manner in which model smoothing is applied.

Consequently Transporters believe that the current averaging approach to model smoothing applied over three years continues to be appropriate and fit for purpose.

FIGURE 1: SMALL NDM (<2,196,000) CONSUMPTION BAND EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

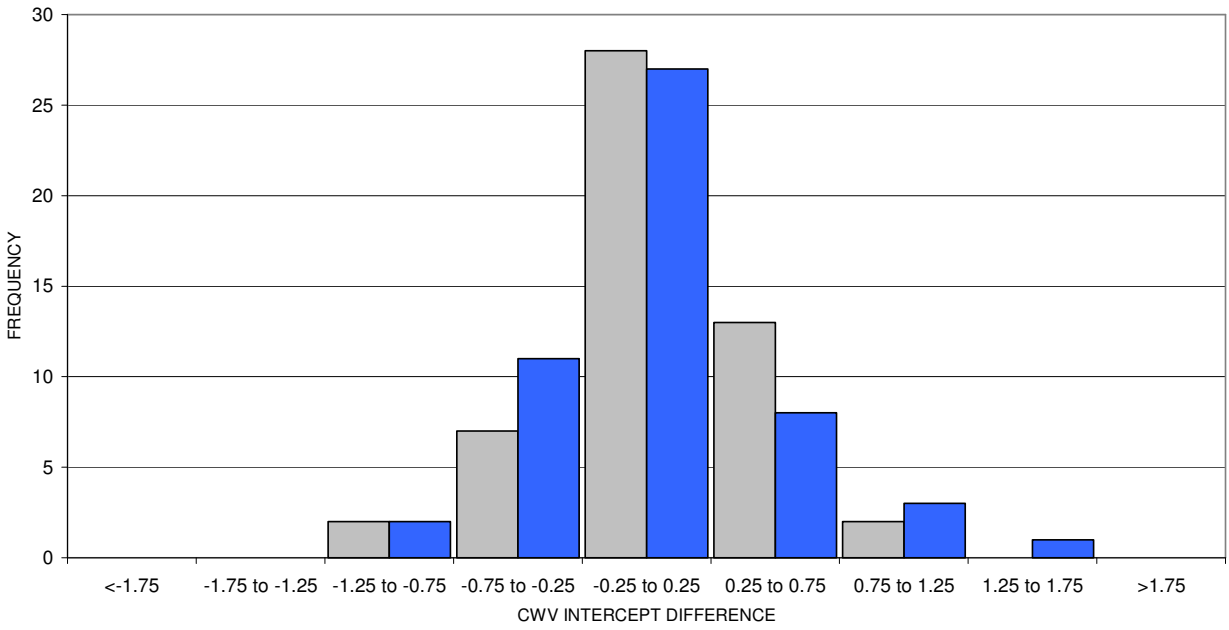

FIGURE 2: LARGE NDM (>2,196,000)CONSUMPTION BAND EUCs - PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

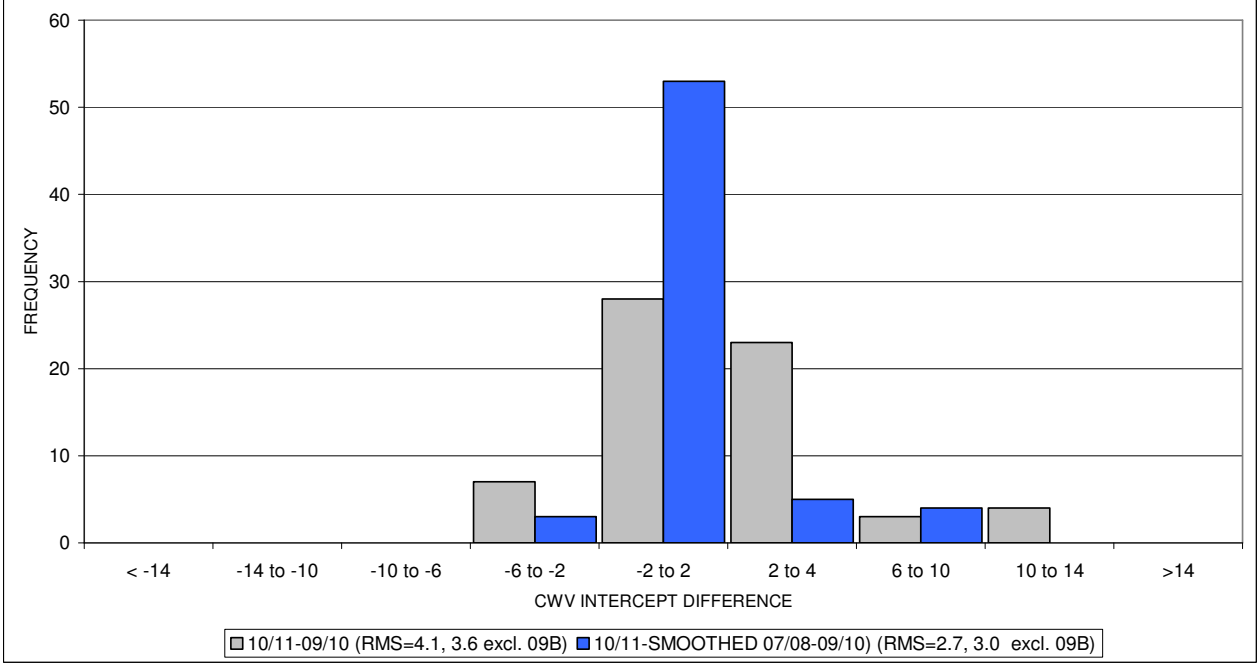

FIGURE 3: SMALL NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

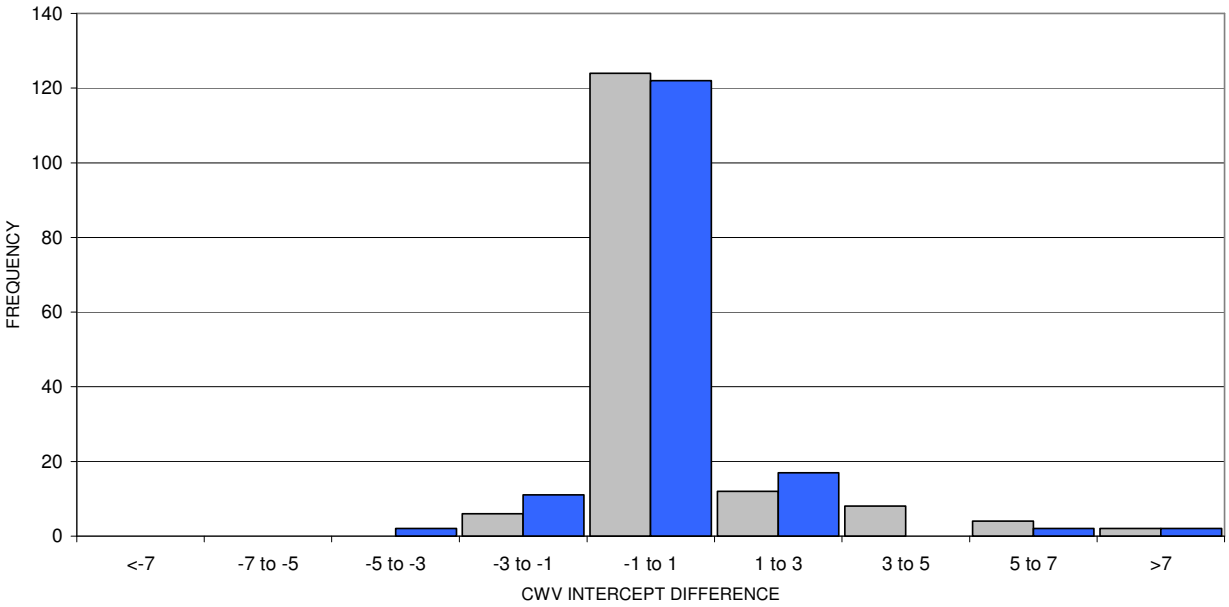

FIGURE 4: LARGE NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

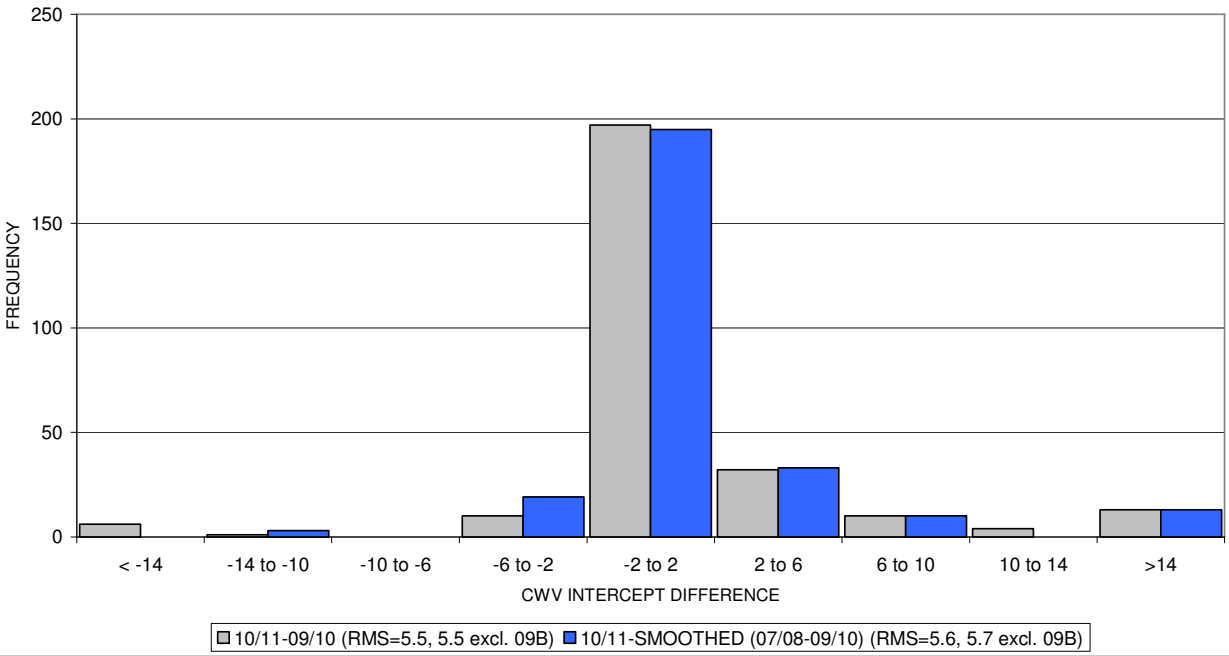

FIGURE 5: SMALL NDM EUCS - YEAR ON YEAR VOLATILITY
10/11 - 09/10 Single Year Model COMPARED TO 11/12 - 10/11 Smoothed Model

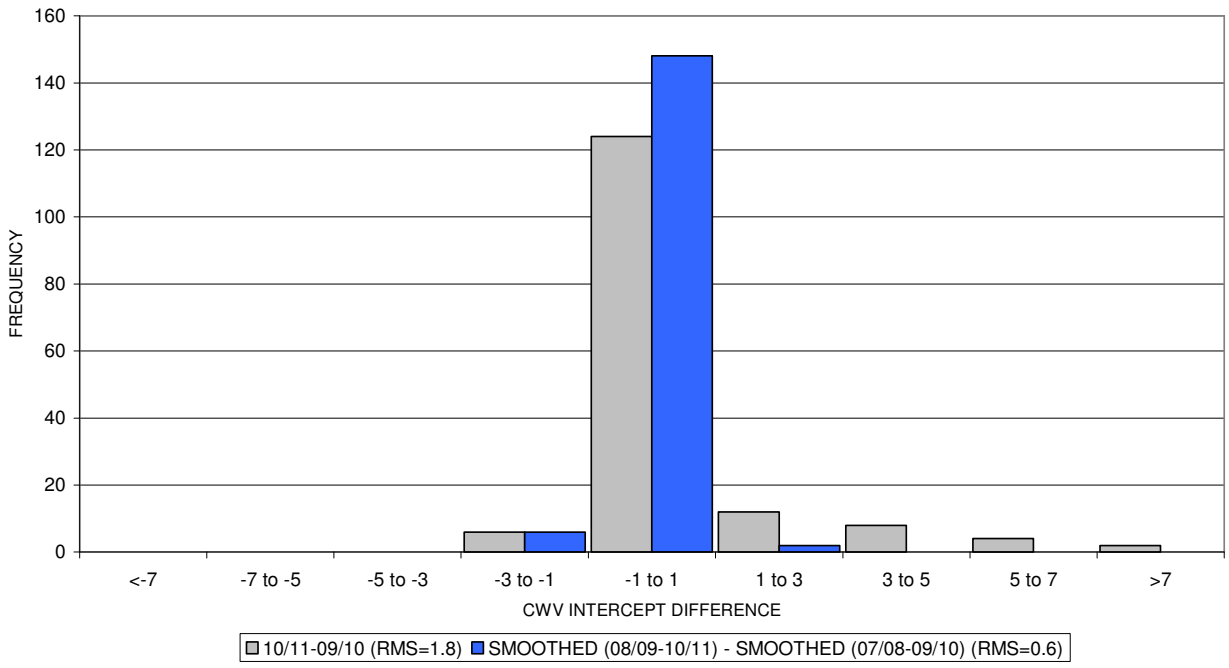

FIGURE 6: LARGE NDM EUCS - YEAR ON YEAR VOLATILITY
10/11 - 09/10 Single Year Model COMPARED TO 11/12 - 10/11 Smoothed Model

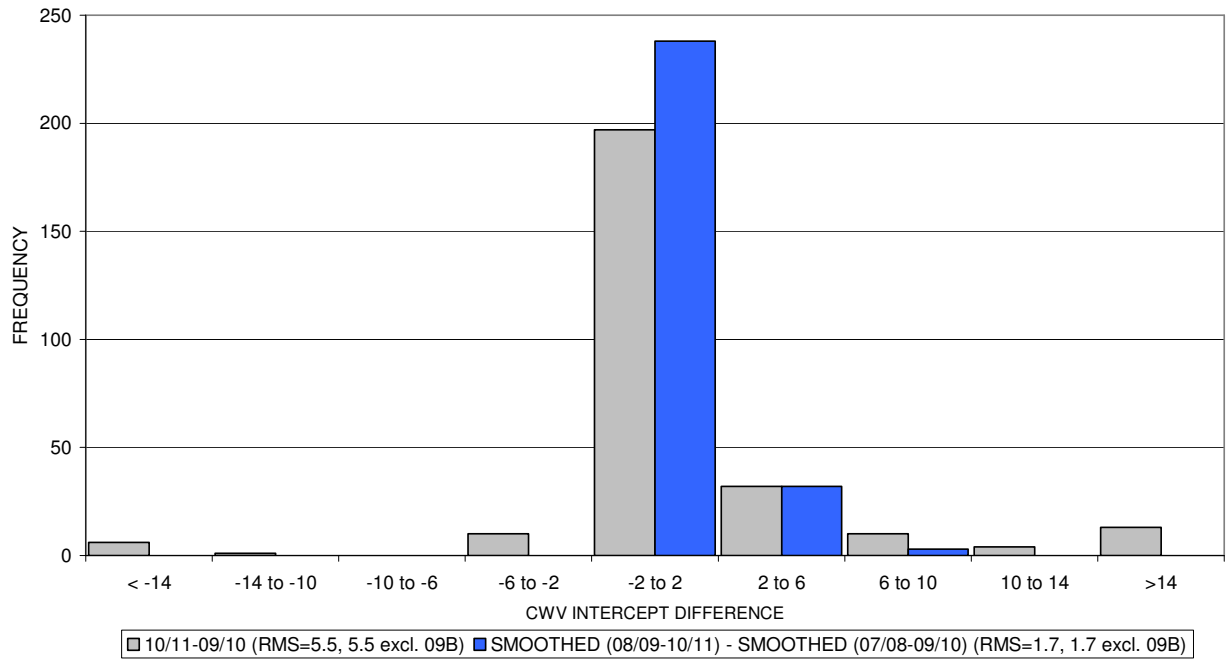

FIGURE 7: SMALL NDM CONSUMPTION BANDS - YEAR ON YEAR VOLATILITY
10/11 - 09/10 Single Year Model COMPARED TO 11/12 - 10/11 Smoothed Model

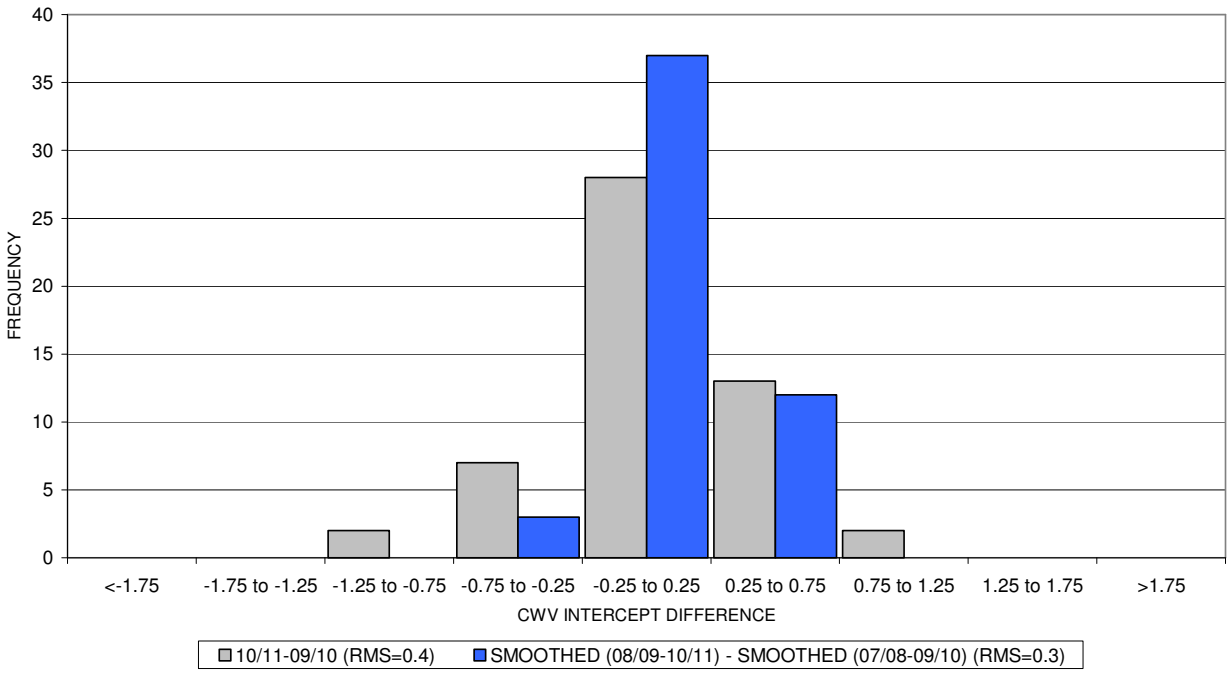

FIGURE 8: LARGE NDM CONSUMPTION BANDS - YEAR ON YEAR VOLATILITY
10/11 - 09/10 Single Year Model COMPARED TO 11/12 - 10/11 Smoothed Model

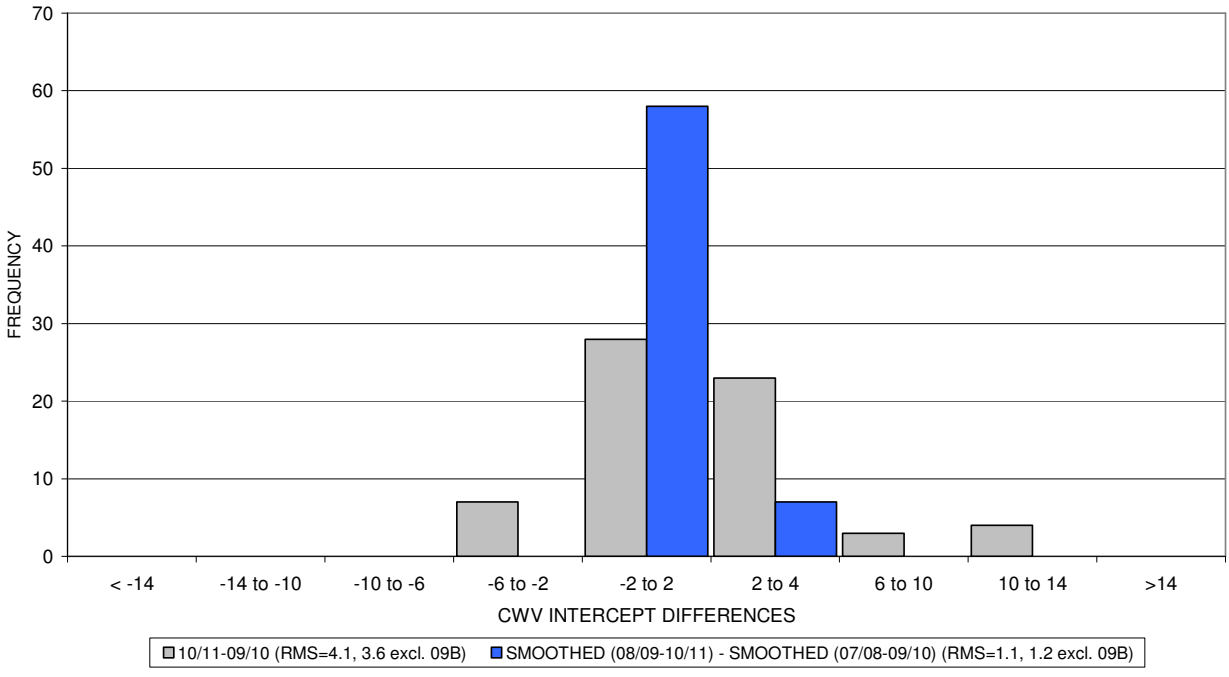

Figure 9: Key for CWV Intercept Pattern Types

3 Years of NDM Demand Models

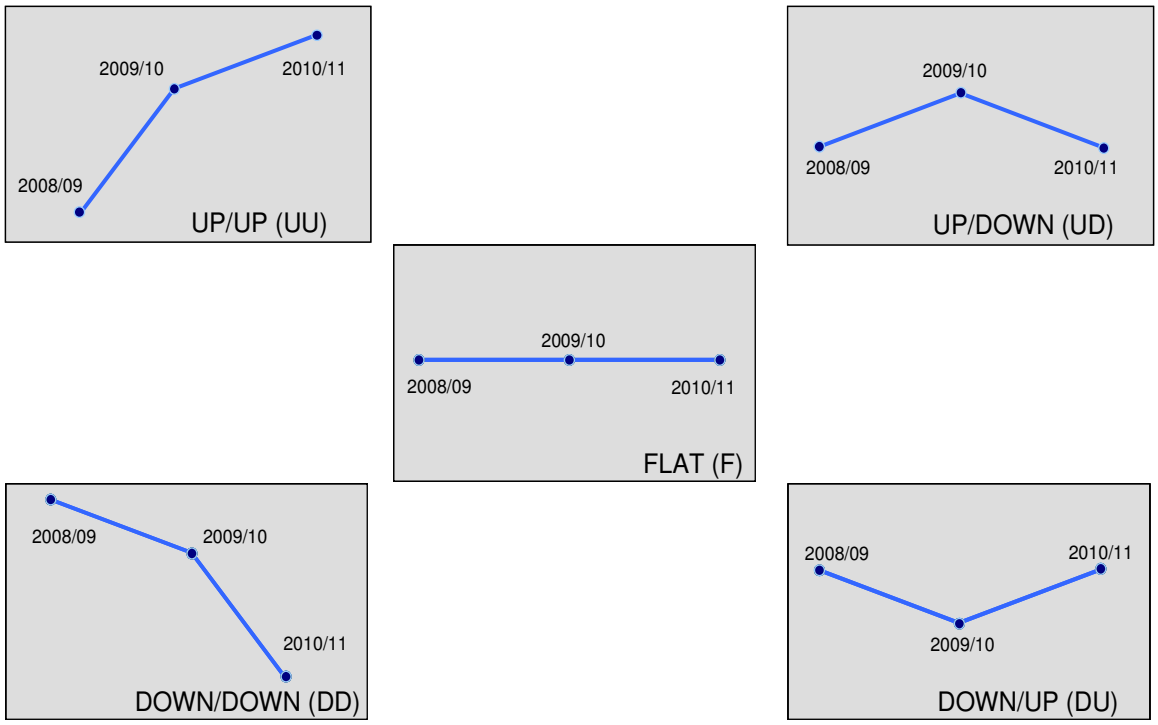

TABLE 1: CWV INTERCEPT PATTERNS
NDM DEMAND MODELS FOR 2008/09, 2009/10, 2010/11

Consumption Band EUCs

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1101B	DD	DU	UD	DD	DD	UD	UD	DD	UD	UD	DD	DU	DU
xx:E1102B	UD	UU	UD	UU	DD	DU	UD	UD	UU	DU	DU	UD	UD
xx:E1103B	DU	DD	UD	DU	DD	DU	UD	UD	DU	DU	DU	UD	DD
xx:E1104B	UU	DU	DD	DU	DU	DU	DD	DU	DD	DU	DU	UD	DU
xx:E1105B	UD	DU	DD	DU	DU	DD	DD	DU	DD	DU	UU	DD	DD
xx:E1106B	UU	DU	UU	DU	DU	DU	UU	DD	UU	UU	UD	DU	UU
xx:E1107B	UU	DU	DU	DU	DU	DU	DU	DU	UU	UU	UU	DU	DU
xx:E1108B	DU	DU	DU	DD	DD	DD	DU	UD	UD	UD	UD	UD	UD
xx:E1109B	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:E1103W01	UU	UU	DU	DU	UU	DU	DU	UD	DU	DU	DU	UU	DU
xx:E1104W01	UU	UU	DU	DU	UU	DU	DU	UD	DU	DU	DU	UU	DU
xx:E1105W01	UD	UD	UD	UD	UD	UD	UD	DU	UD	UD	UD	DU	DU
xx:E1106W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E1107W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E1108W01	F	F	F	F	F	F	F	F	F	F	F	F	F

Second (ie. W02) ,WAR Bands in Each Consumption Range

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1103W02	UU	DU	DD	UU	DU	UD	DD	DU	DD	DU	DU	UD	DU
xx:E1104W02	UU	DU	DD	UU	DU	UD	DD	DU	DD	DU	DU	UD	DU
xx:E1105W02	UU	UU	DU	UD	UD	UD	DU	DD	DD	UD	DD	DD	DD
xx:E1106W02	UU	UU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU
xx:E1107W02	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E1108W02	DU	DU	DU	DU	DU	DU	DU	DU	DD	DU	DU	DU	DU

Third (ie. W03) ,WAR Bands in Each Consumption Range

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1103W03	UD	UD	UD	UD	UD	UD	UD	UD	DD	UD	DD	DU	UD
xx:E1104W03	UD	UD	UD	UD	UD	UD	UD	UD	DD	UD	DD	DU	UD
xx:E1105W03	UU	UU	DU	UD	UD	DU	DU	DU	DU	DU	DU	DD	DU
xx:E1106W03	UU	UU	DU	UU	UU	UU	DU	DU	DU	DU	DU	DU	DU
xx:E1107W03	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E1108W03	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU

Fourth (ie. peakiest, W04) ,WAR Bands in Each Consumption Range

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1103W04	UD	UD	DD	UD	DU	DU	DD	DD	DD	DD	DU	DD	DD
xx:E1104W04	UD	UD	DD	UD	DU	DU	DD	DD	DD	DD	DU	DD	DD
xx:E1105W04	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DD	DU
xx:E1106W04	UU	UU	UD	UU	UU	UD	UD	DU	DU	DU	DU	DU	DU
xx:E1107W04	UU	UU	DU	UD	DU	DU	DU	DU	UU	UU	UU	DU	DU
xx:E1108W04	UU	UU	UD	UD	UD	UD	UD	UU	UD	UD	UD	UD	UU

KEY

UU	UP UP 2008/09 < 2009/10 < 2010/11
UD	UP DOWN 2008/09 < 2009/10 >= 2010/11
DU	DOWN UP 2008/09 >= 2009/10 < 2010/11
DD	DOWN DOWN 2008/09 > 2009/10 > 2010/11
F	FLAT OR NEARLY FLAT MODELS

TABLE 2: CWV INTERCEPTS PATTERNS: NDM DEMAND MODELS FOR 2008/09, 2009/10 AND 2010/11
COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type					Total	
	UU	UD	DU	DD	F		
xx:E1101B	0	5	3	5	0	13	
xx:E1102B	3	6	3	1	0	13	
xx:E1103B	0	4	6	3	0	13	
xx:E1103W01	4	1	8	0	0	13	
xx:E1103W02	2	2	6	3	0	13	
xx:E1103W03	0	10	1	2	0	13	
xx:E1103W04	0	3	3	7	0	13	
xx:E1104B	1	1	8	3	0	13	
xx:E1104W01	4	1	8	0	0	13	
xx:E1104W02	2	2	6	3	0	13	
xx:E1104W03	0	10	1	2	0	13	
xx:E1104W04	0	3	3	7	0	13	
xx:E1105B	1	1	5	6	0	13	
xx:E1105W01	0	10	3	0	0	13	
xx:E1105W02	2	4	2	5	0	13	
xx:E1105W03	2	2	8	1	0	13	
xx:E1105W04	0	0	12	1	0	13	
xx:E1106B	6	1	5	1	0	13	
xx:E1106W01	0	0	0	0	13	13	
xx:E1106W02	2	0	11	0	0	13	
xx:E1106W03	5	0	8	0	0	13	
xx:E1106W04	4	3	6	0	0	13	
xx:E1107B	4	0	9	0	0	13	
xx:E1107W01	0	0	0	0	13	13	
xx:E1107W02	13	0	0	0	0	13	
xx:E1107W03	13	0	0	0	0	13	
xx:E1107W04	5	1	7	0	0	13	
xx:E1108B	0	6	4	3	0	13	
xx:E1108W01	0	0	0	0	13	13	
xx:E1108W02	0	0	12	1	0	13	
xx:E1108W03	13	0	0	0	0	13	
xx:E1108W04	4	9	0	0	0	13	
xx:E1109B	0	0	13	0	0	13	
Total by Type	**90**	**85**	**161**	**54**	**39**	**429**	Autumn 2011
2007/08, 2008/09 and 2009/10 Analysis Years	52	214	91	33	39	429	Autumn 2010
2006/07, 2007/08 and 2008/09 Analysis Years	129	123	101	37	39	429	Autumn 2009
2005/06, 2008/09 and 2009/10 Analysis Years	46	81	173	90	39	429	Autumn 2008
2004/05, 2005/06 and 2008/09 Analysis Years	28	195	68	99	39	429	Autumn 2007
2003/04, 2004/05 and 2005/06 Analysis Years	109	169	65	48	38	429	Autumn 2006
2002/03, 2003/04 and 2004/05 Analysis Years	99	111	151	33	35	429	Autumn 2005
2001/02, 2002/03 and 2003/04 Analysis Years	62	95	182	57	33	429	Autumn 2004
2000/01, 2001/02 and 2002/03 Analysis Years	21	145	130	94	39	429	Autumn 2003
1999/00, 2000/01 and 2001/02 Analysis Years	66	194	80	50	39	429	Autumn 2002
1998/99, 1999/00 and 2000/01 Analysis Years	39	83	186	82	39	429	Autumn 2001
1997/98, 1998/99 and 1999/00 Analysis Years	77	223	58	31	40	429	Autumn 2000
1996/97, 1997/98 and 1998/99 Analysis Years	57	46	233	54	39	429	Autumn 1999

LDZ	Type					Total
	UU	UD	DU	DD	F	
SC	17	7	5	1	3	33
NO	13	5	11	1	3	33
NW	4	8	12	6	3	33
NE	8	9	11	2	3	33
EM	7	6	13	4	3	33
WM	4	9	15	2	3	33
WN	4	8	12	6	3	33
WS	4	7	14	5	3	33
EA	7	4	9	10	3	33
NT	6	7	15	2	3	33
SE	6	4	16	4	3	33
SO	5	7	12	6	3	33
SW	5	4	16	5	3	33
Totals	90	85	161	54	39	429

KEY	
UU	Increasing Trend
UD	Increasing then decreasing Trend
DU	Decreasing then increasing Trend
DD	Decreasing Trend
F	Flat model

TABLE 3: CWV INTERCEPTS PATTERNS: NDM DEMAND MODELS FOR 2007/08, 2008/09, 2009/10 AND 2010/11
COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type				Total	
	N	U	D	F		
xx:E1101B	12	1	0	0	13	
xx:E1102B	11	0	2	0	13	
xx:E1103B	12	1	0	0	13	
xx:E1103W01	13	0	0	0	13	
xx:E1103W02	13	0	0	0	13	
xx:E1103W03	13	0	0	0	13	
xx:E1103W04	12	1	0	0	13	
xx:E1104B	12	0	1	0	13	
xx:E1104W01	13	0	0	0	13	
xx:E1104W02	13	0	0	0	13	
xx:E1104W03	13	0	0	0	13	
xx:E1104W04	12	1	0	0	13	
xx:E1105B	11	1	1	0	13	
xx:E1105W01	13	0	0	0	13	
xx:E1105W02	13	0	0	0	13	
xx:E1105W03	13	0	0	0	13	
xx:E1105W04	13	0	0	0	13	
xx:E1106B	9	0	4	0	13	
xx:E1106W01	0	0	0	13	13	
xx:E1106W02	11	0	2	0	13	
xx:E1106W03	11	0	2	0	13	
xx:E1106W04	13	0	0	0	13	
xx:E1107B	13	0	0	0	13	
xx:E1107W01	0	0	0	13	13	
xx:E1107W02	13	0	0	0	13	
xx:E1107W03	13	0	0	0	13	
xx:E1107W04	10	0	3	0	13	
xx:E1108B	13	0	0	0	13	
xx:E1108W01	0	0	0	13	13	
xx:E1108W02	13	0	0	0	13	
xx:E1108W03	6	0	7	0	13	
xx:E1108W04	13	0	0	0	13	
xx:E1109B	13	0	0	0	13	
2007/08, 2008/09, 2009/10 and 2010/11 Analysis Years	363	5	22	39	429	Autumn 2011
2006/07, 2007/08, 2008/09 and 2009/10 Analysis Years	364	6	20	39	429	Autumn 2010
2005/06, 2006/07, 2007/08 and 2008/09 Analysis Years	356	18	16	39	429	Autumn 2009
2004/05, 2005/06, 2006/07 and 2007/08 Analysis Years	352	25	13	39	429	Autumn 2008
2003/04, 2004/05, 2005/06 and 2006/07 Analysis Years	353	19	19	38	429	Autumn 2007
2002/03, 2003/04, 2004/05 and 2005/06 Analysis Years	355	10	29	35	429	Autumn 2006
2001/02, 2002/03, 2003/04 and 2004/05 Analysis Years	360	9	25	35	429	Autumn 2005
2000/01, 2001/02, 2002/03 and 2003/04 Analysis Years	364	23	9	33	429	Autumn 2004
1999/00, 2000/01, 2001/02 and 2002/03 Analysis Years	353	32	5	39	429	Autumn 2003
1998/99, 1999/00, 2000/01 and 2001/02 Analysis Years	352	26	12	39	429	Autumn 2002
1997/98, 1998/99, 1999/00 and 2000/01 Analysis Years	348	15	27	39	429	Autumn 2001
1996/97, 1997/98, 1998/99 and 1999/00 Analysis Years	361	15	14	39	429	Autumn 2000

LDZ	Type				Total
	N	U	D	F	
SC	28	0	2	3	33
NO	29	0	1	3	33
NW	28	0	2	3	33
NE	28	0	2	3	33
EM	28	1	1	3	33
WM	30	0	0	3	33
WN	28	0	2	3	33
WS	30	0	0	3	33
EA	25	1	4	3	33
NT	28	0	2	3	33
SE	27	0	3	3	33
SO	29	0	1	3	33
SW	25	3	2	3	33
Totals	363	5	22	39	429

KEY	
N	No consistent trend over 4 years
U	Increasing values over 4 years
D	Decreasing values over 4 years
F	Flat or nearly flat models

Figure 10: Load Factors for each LDZ - xx:E1101B

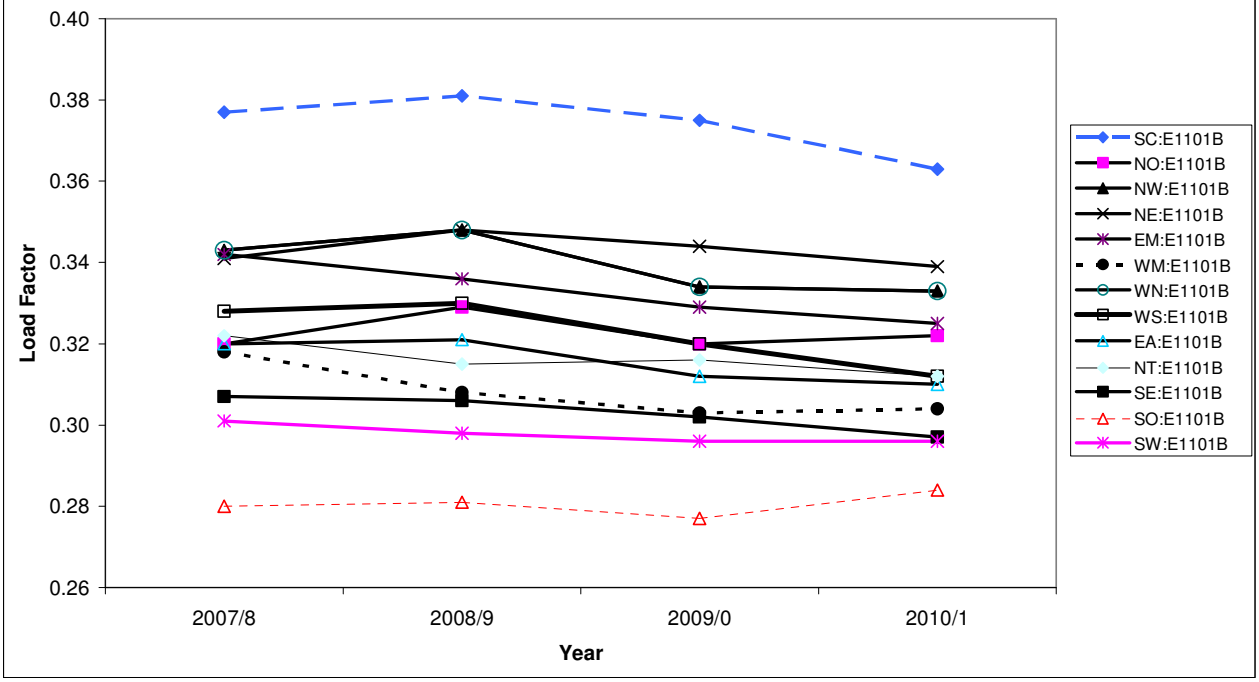

Figure 11: Load Factors for each LDZ - xx:E1102B

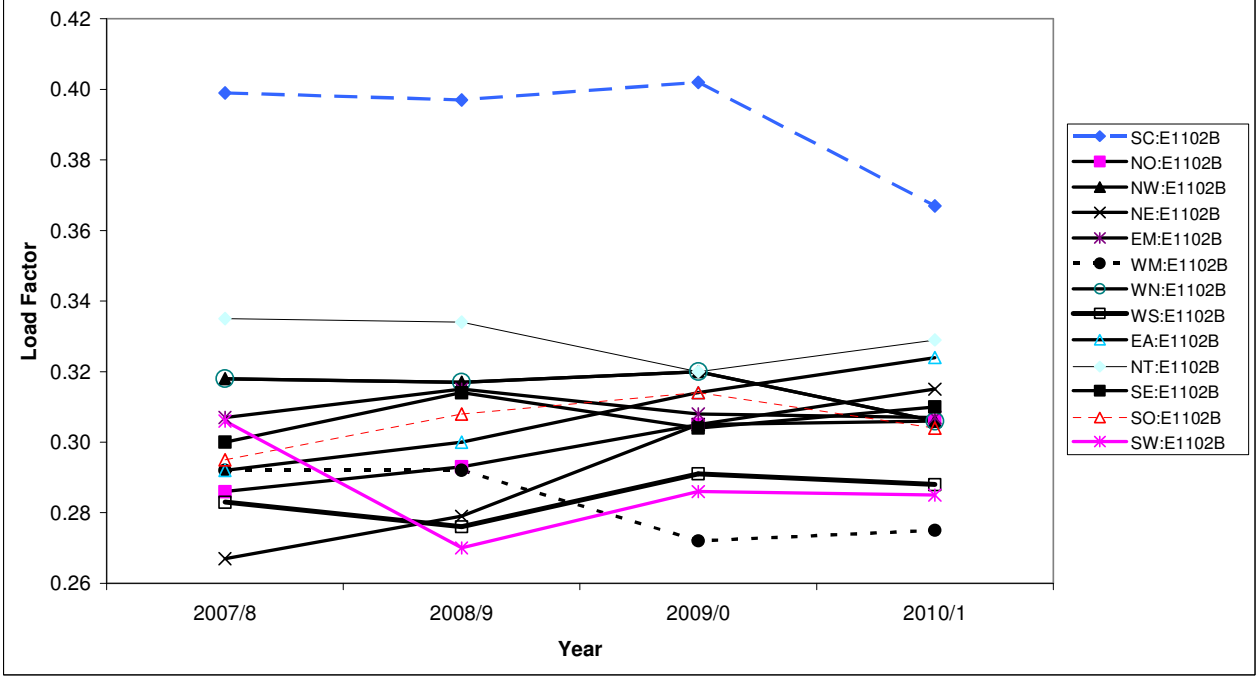

Figure 12: Load Factors for each LDZ - xx:E1103B

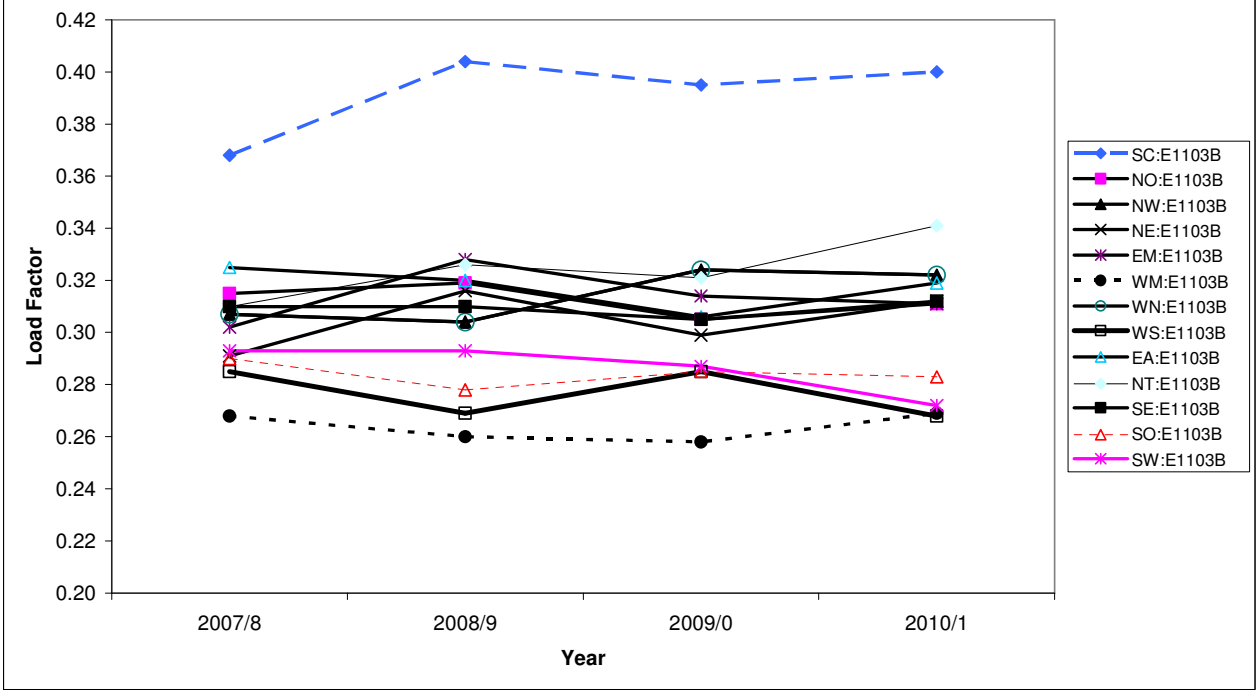

Figure 13: Load Factors for each LDZ - xx:E1104B

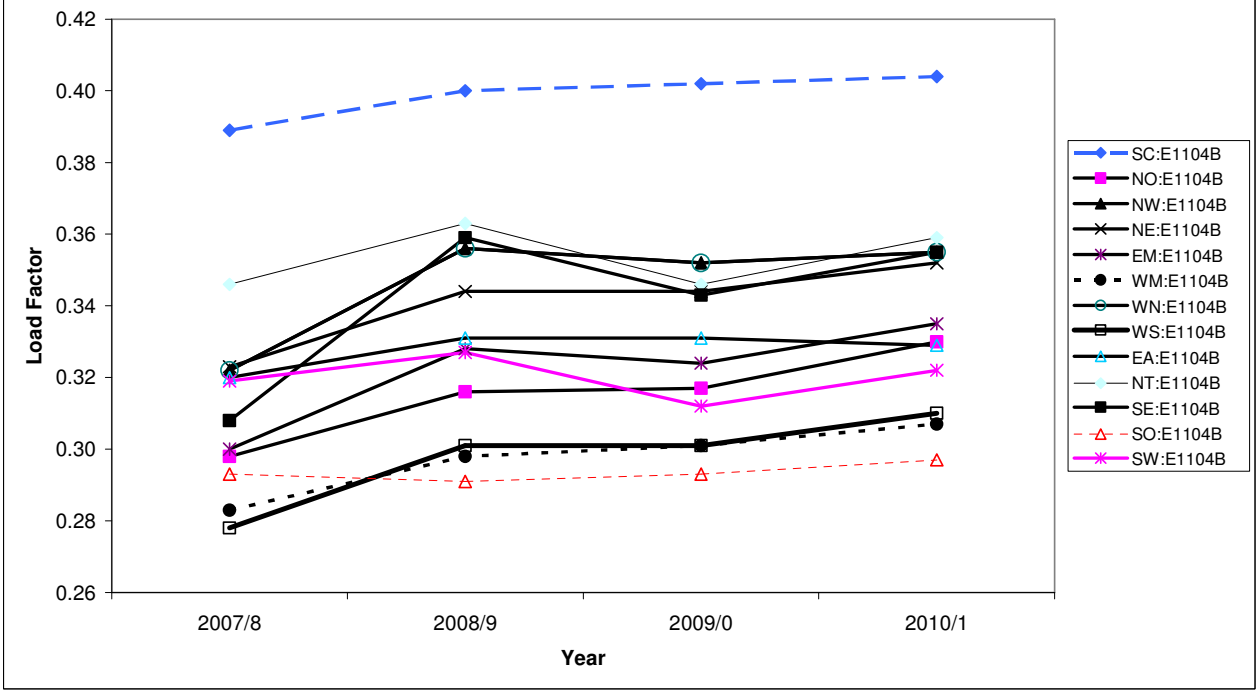

Figure 14: Load Factors for each LDZ - xx:E1105B

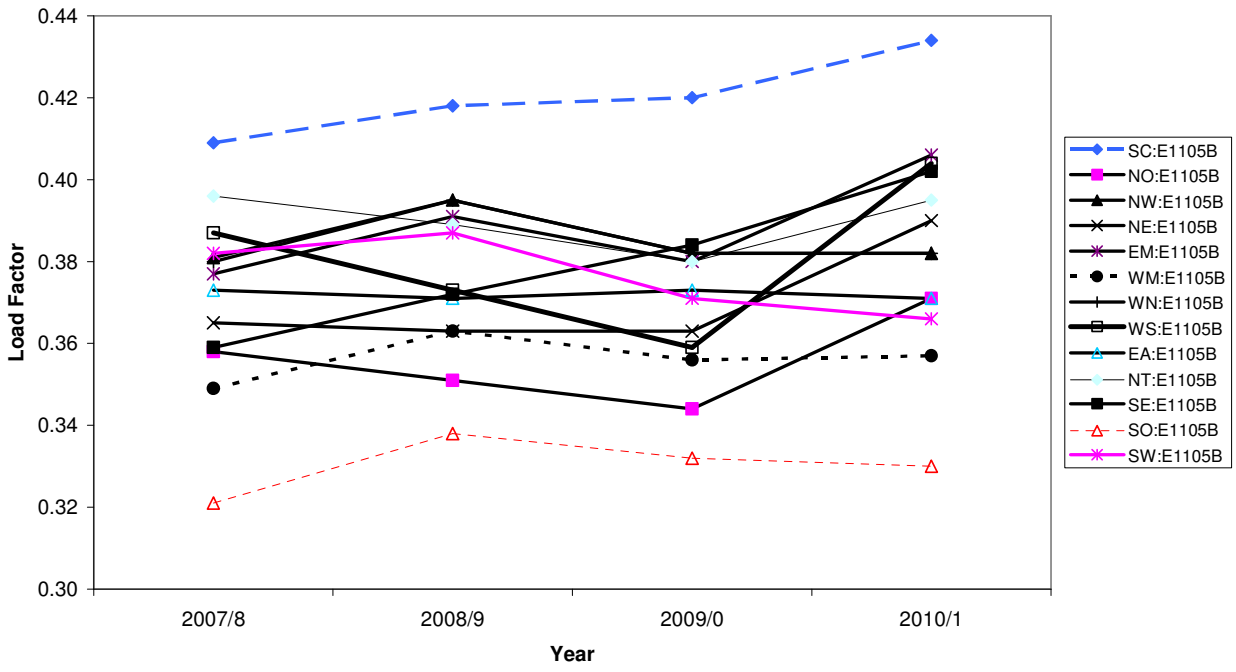

Figure 15: Load Factors for each LDZ - xx:E1106B

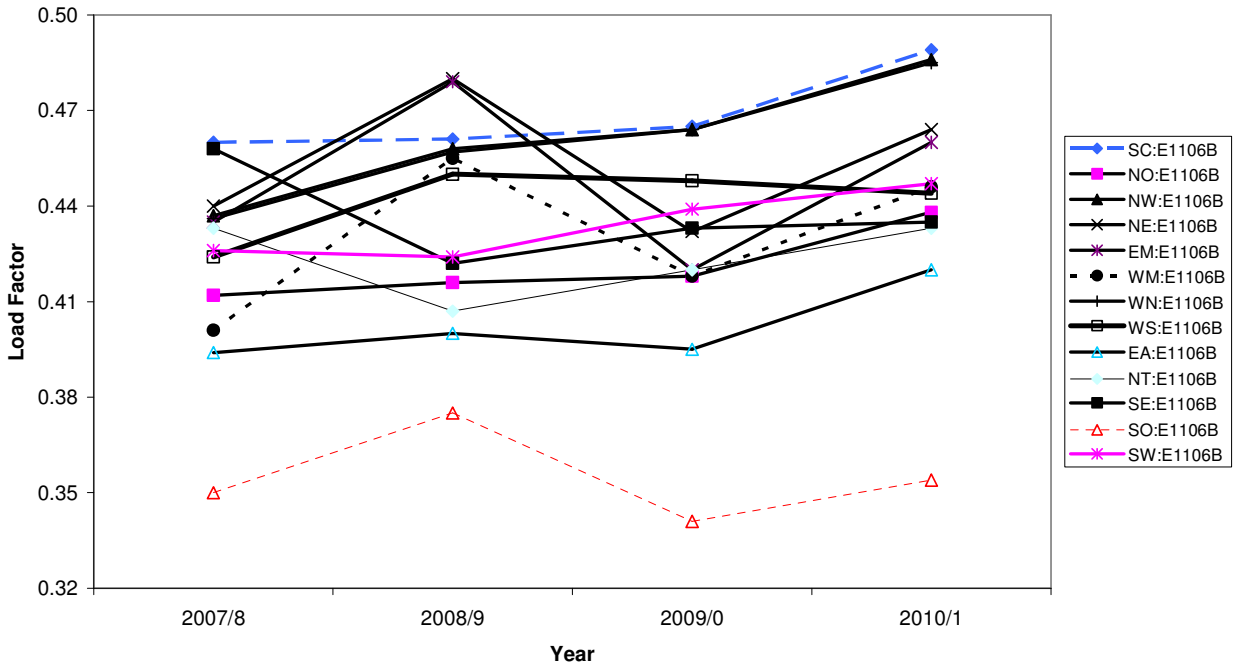

Figure 16: Load Factors for each LDZ - xx:E1107B

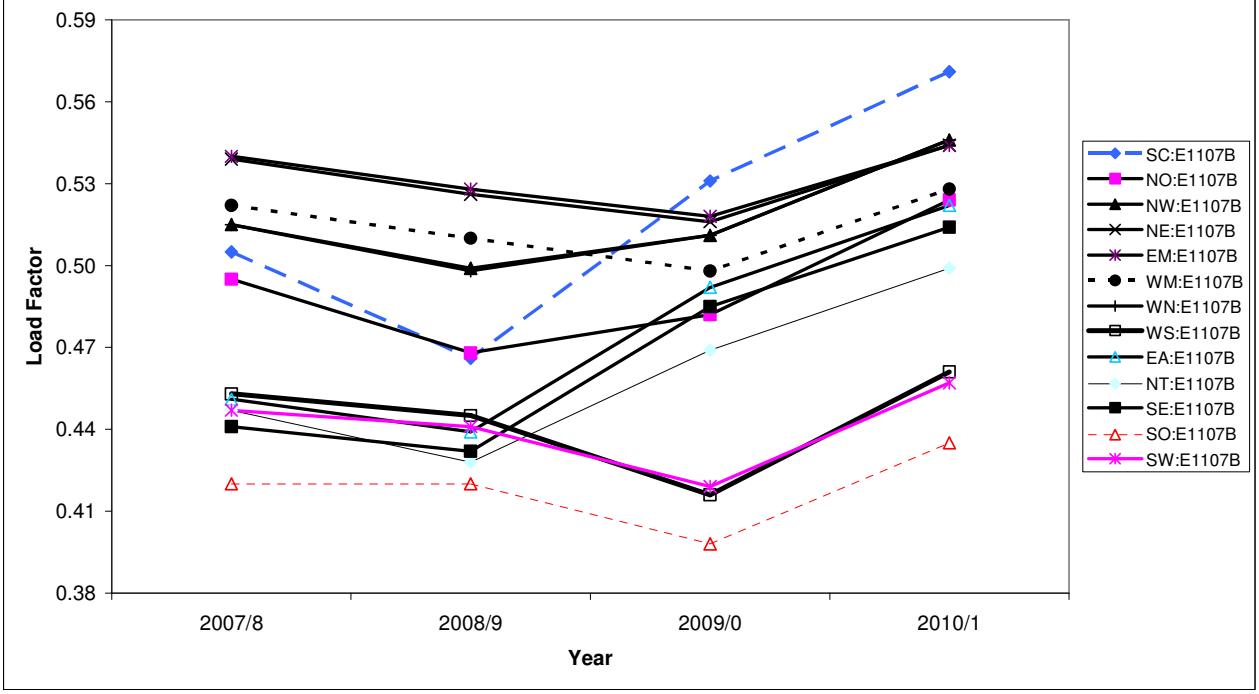

Figure 17: Load Factors for each LDZ - xx:E1108B

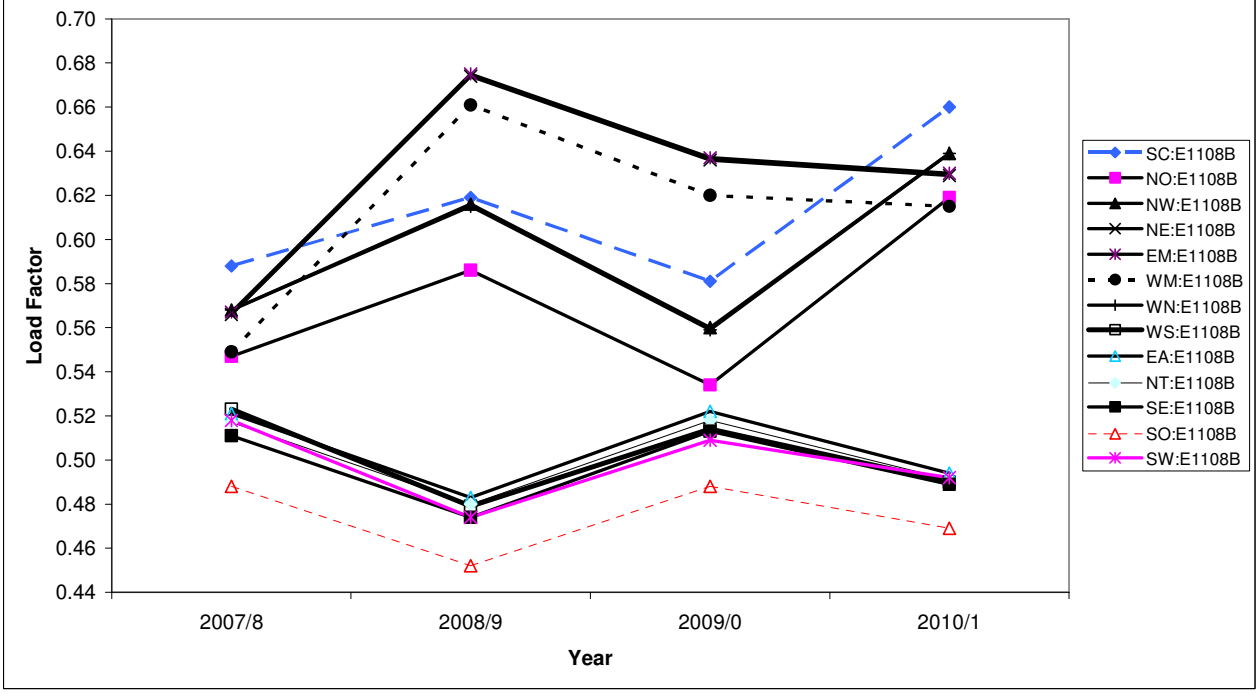

Figure 18: Load Factors for each LDZ - xx:E1109B

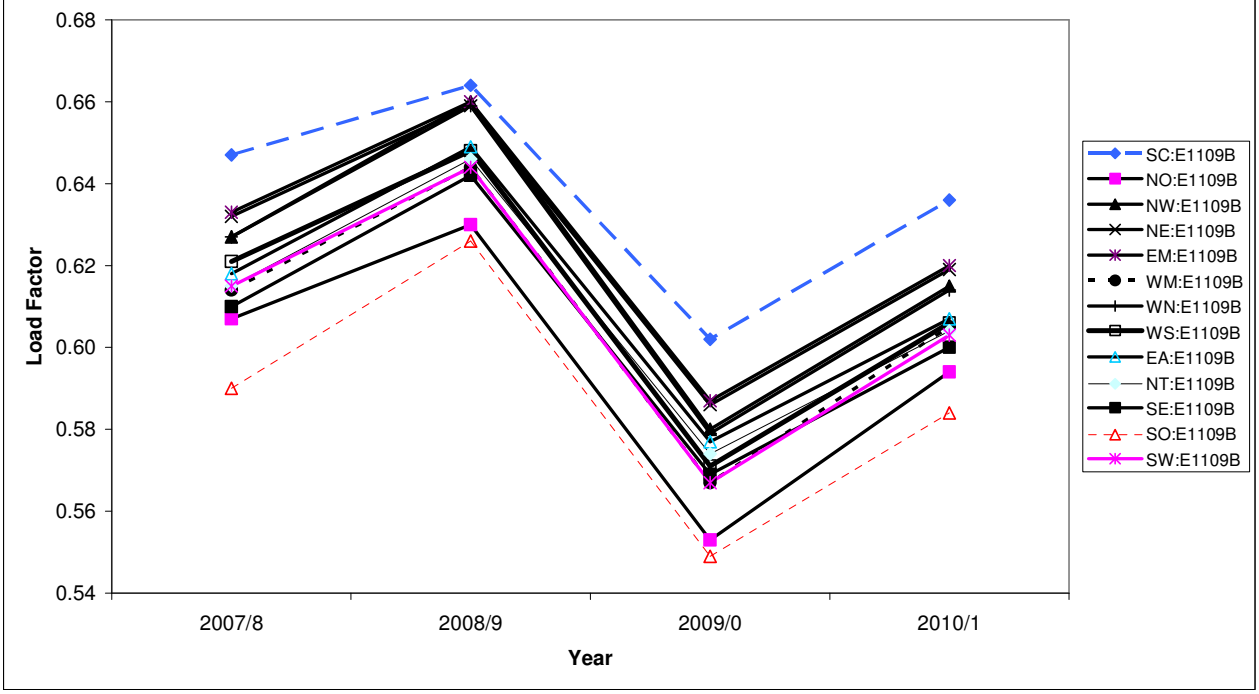

Figure 19: Load Factors for each LDZ - xx:E1108W03