



DESC Technical Workgroup

Model Smoothing Evaluation

17th November 2015

Agenda

- Key objectives for Technical Workgroup from this presentation:
 - To review the results of the model smoothing methodology review
 - To provide a recommendation to DESC for its future use and/or reviews

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Model Smoothing: Background

- Model smoothing was first undertaken in 1999/00 and has been applied to all subsequent years based on the methodology detailed in Spring Approach document
- In January 2006, DESC agreed to move to a biennial assessment of the continued applicability of model smoothing
- The analysis presented today is the first full assessment of model smoothing since Autumn 2013 and has been carried out along the same lines
- Presentation summarises the results and conclusions, however supporting document also available which provides further detailed commentary and analysis – document name: *DESC_Model Smoothing Review_Autumn15.pdf*

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Model Smoothing: Principles

- Model smoothing is the averaging of 3 years of models (including the current and most recent data sets) to derive new parameters
- Introduced to address year on year volatility and provide more stability in EUC models
- Model smoothing will not necessarily improve model predictability, however it may be better than single year models
- Analysis performed considers i) volatility, ii) predictability and iii) trend analysis
- Model smoothing assessments are undertaken using the CWV intercept differences from the relevant single year or smoothed models

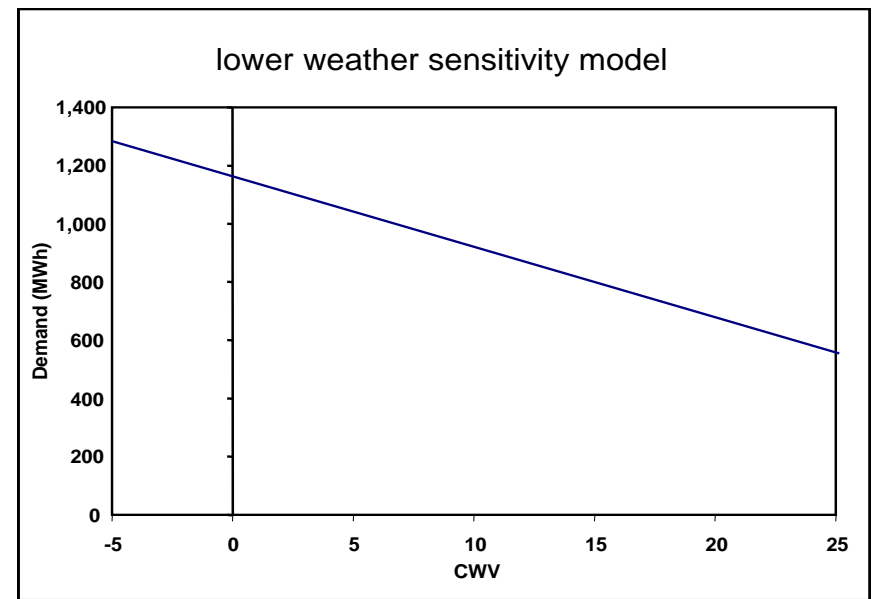
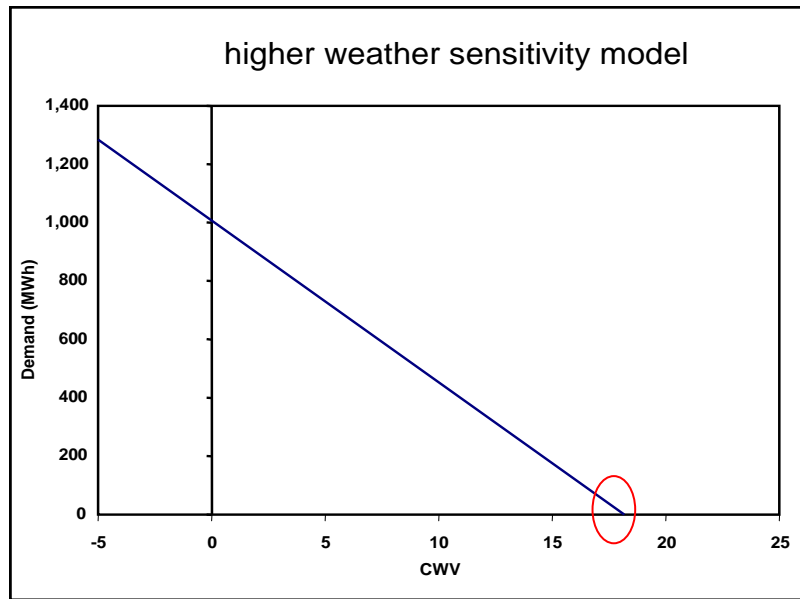
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Model Smoothing: CWV Intercepts

- Appendix 6 of annual NDM report contains individual year and smoothed model CWV intercepts



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Model Smoothing: Assessment of Volatility

Single Year Data Sets

2012/13 (Yr.1)

2013/14 (Yr.2)

2014/15 (Yr.3)

2011/12 (Yr.1)

2012/13 (Yr.2)

2013/14 (Yr.3)

Smoothed Model (Sm)

for Gas Year 2015/16 (Sm)

for Gas Year 2014/15 (Sm)

! Most recent data
set available is
2014/15

Single Year Test

Examines 2014/15 (Yr.3) against 2013/14 (Yr.2) indicating extent of year on year change

Smoothed Model Test

Examines 2015/16 (Sm) against 2014/15 (Sm) indicating extent of year on year change

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Model Smoothing Results 1: Volatility Analysis

- Aim:
To assess the level of year on year volatility of each model type (smoothed and single year) by comparing the differences between each year. This is achieved by using variations in the CWV intercepts and calculating the overall RMS values
- Analysis:
 - Smoothed Year Model comparisons
Applicable Smoothed model for '15/16 (*based on '12/13, '13/14, '14/15*) compared to
applied Smoothed model for '14/15 (*based on '11/12, '12/13, '13/14*)
 - Single Year Model comparisons
Single year model for '14/15 (*that would have been applied to '15/16*) compared to
Single year model for '13/14 (*that would have been applied to '14/15*)

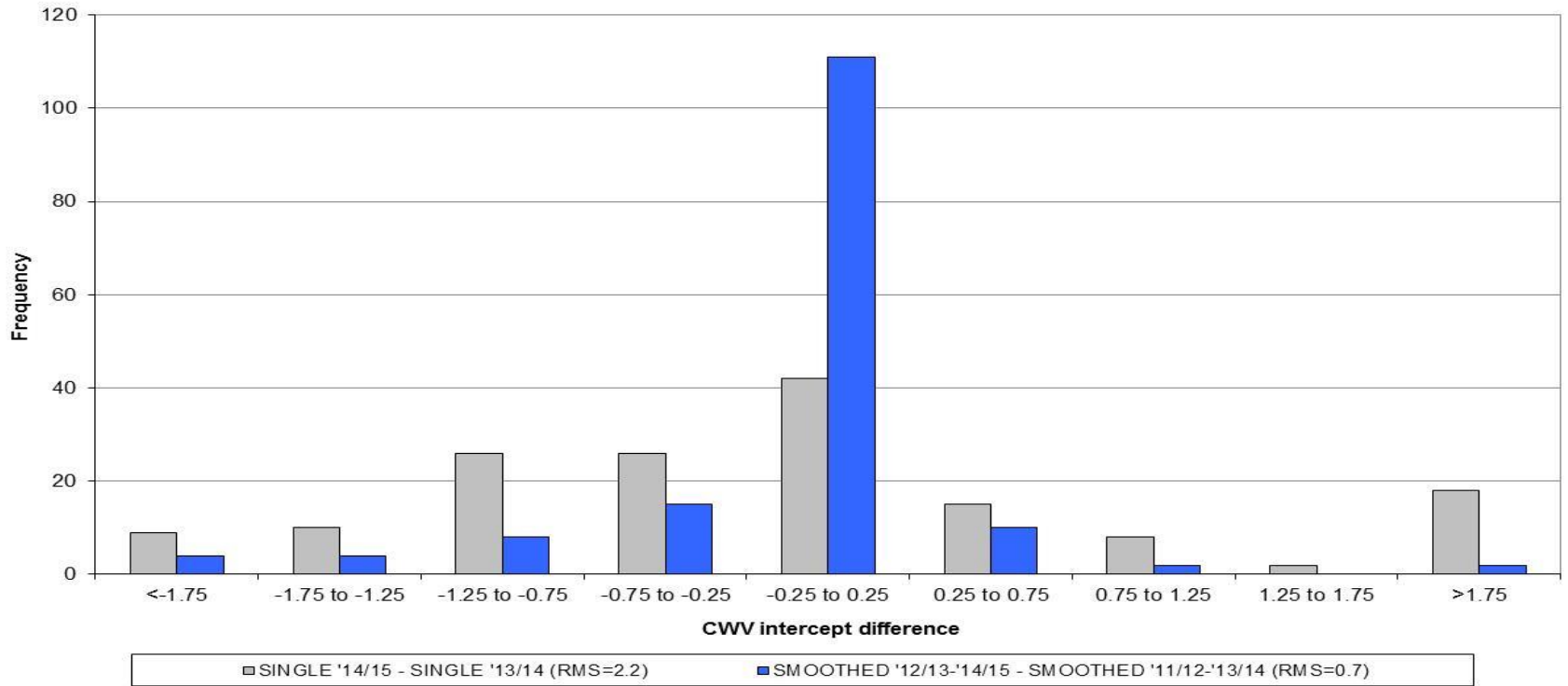
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Volatility Analysis: Small NDM - All EUC Bands

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



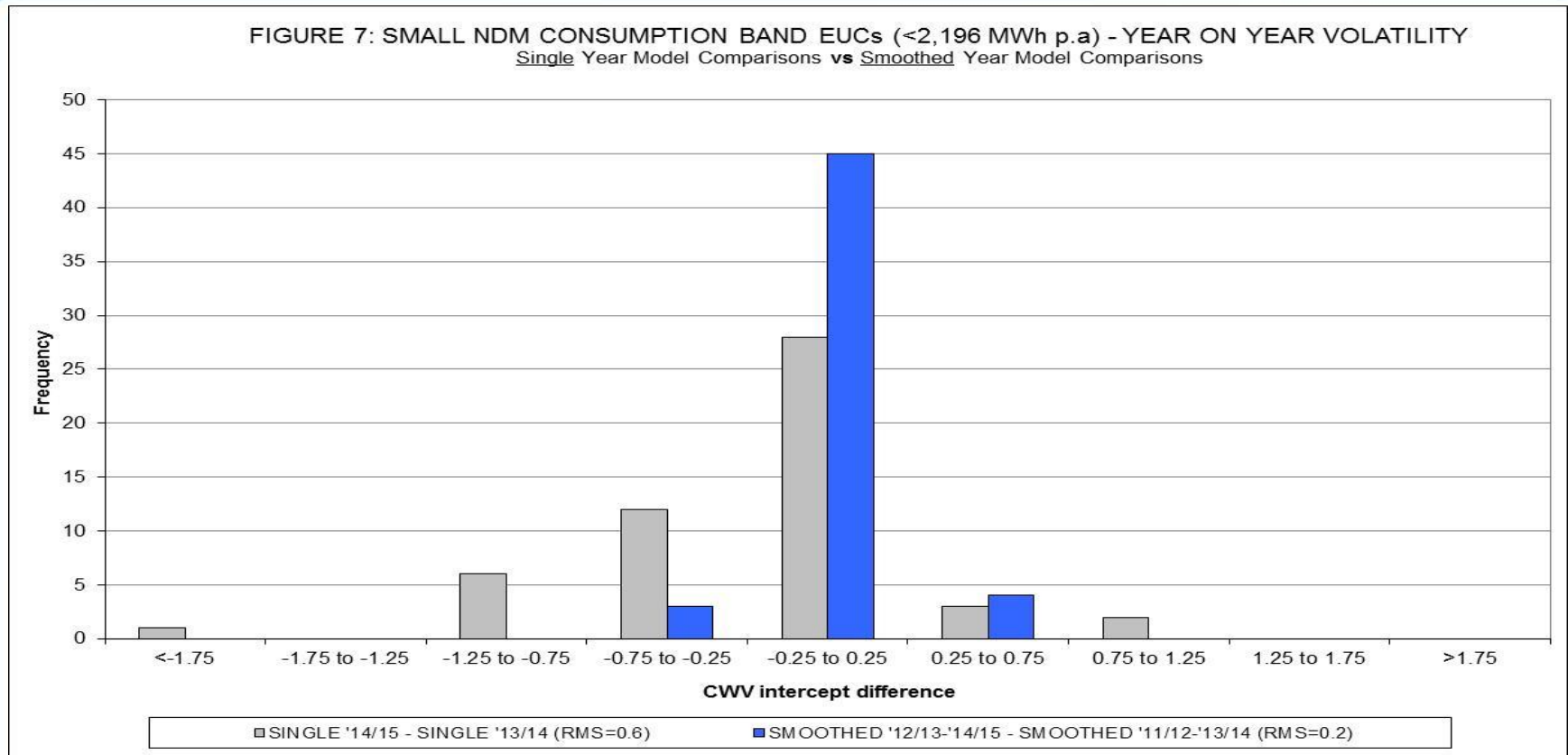
- 156 Small NDM EUCs assessed
- Smoothed Model clearly has smaller CWV intercept differences and lower RMS values and so overall less volatility

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Volatility Analysis: Small NDM – Consumption Bands



- 52 Small NDM Consumption Bands assessed
- Smoothed Model has smaller CWV intercept differences and lower RMS values and so overall less volatility

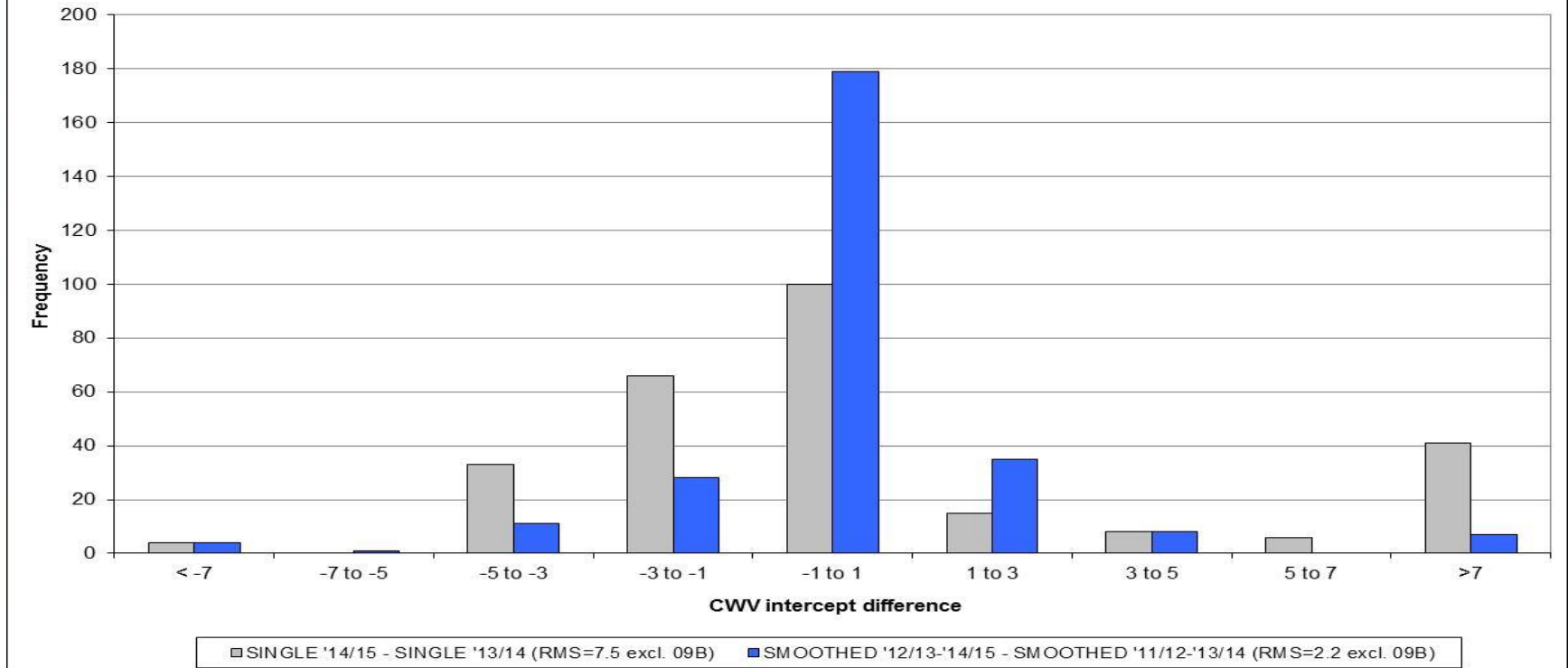
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Volatility Analysis: Large NDM – All EUC Bands

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



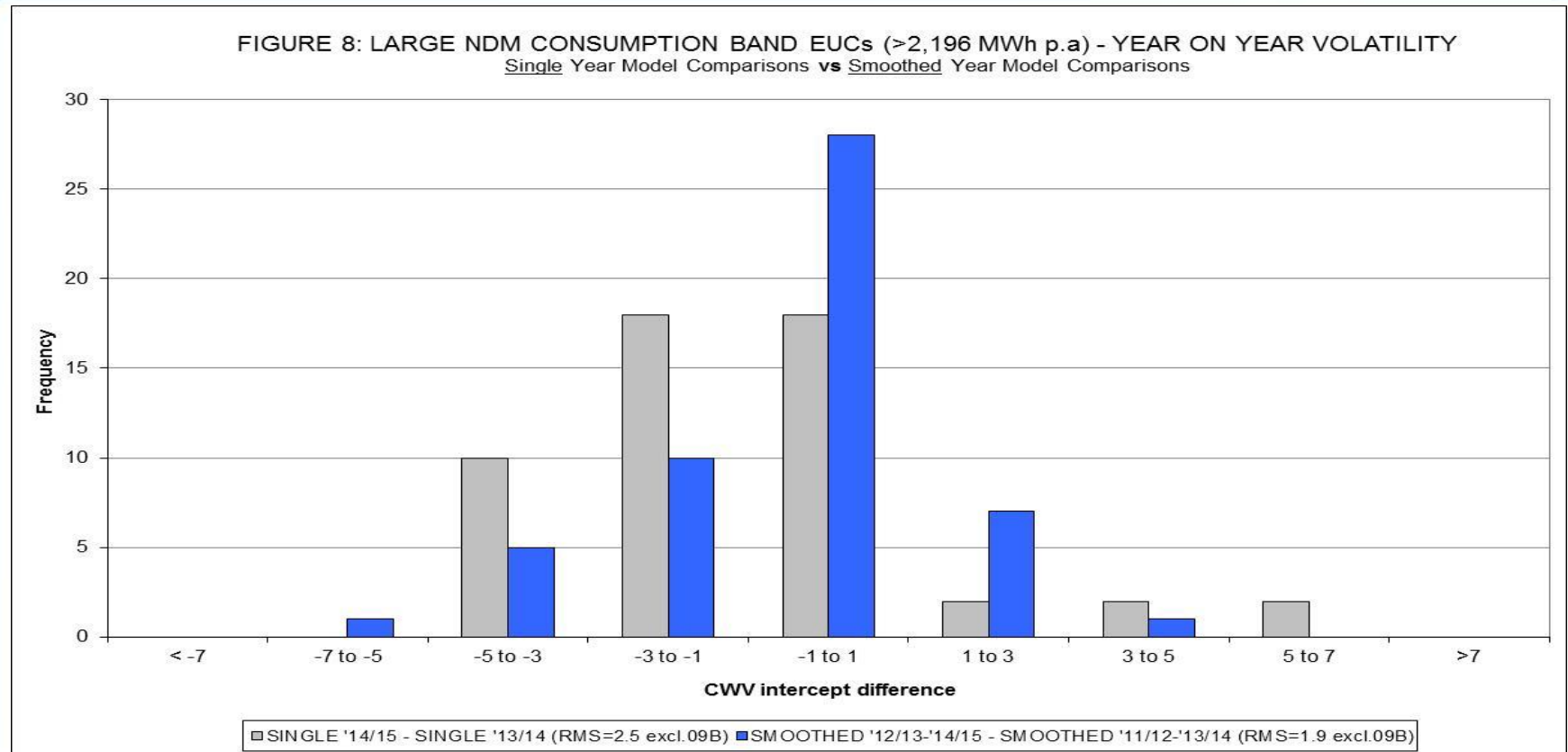
- 273 Large NDM EUCs assessed
- Smoothed Model clearly has smaller CWV intercept differences and lower RMS values and so overall less volatility

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Volatility Analysis: Large NDM – Consumption Bands



- 52 Large NDM Consumption Bands assessed
- Smoothed Model has smaller CWV intercept differences and lower RMS values and so overall less volatility

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Model Smoothing Results 1: Volatility Assessment

- Analysis shows that the smoothed models for Large and Small NDM EUCs are associated with significantly lower year on year volatility as shown by:
 - Generally narrower distribution of CWV intercept differences
 - Generally notable reductions in the corresponding RMS values
- Further analysis carried out to assess predictive ability.....

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Model Smoothing: Assessment of Predictability

Single Year Data Sets

2012/13 (Yr.1)

2013/14 (Yr.2)

2014/15 (Yr.3)

2011/12 (Yr.1)

2012/13 (Yr.2)

2013/14 (Yr.3)

Smoothed Model (Sm)

for Gas Year 2015/16 (Sm)

for Gas Year 2014/15 (Sm)

! Most recent data
set available is
2014/15

Single Year Model Test ⁽¹⁾

Examines **2014/15 (Yr.3)** against **2013/14 (Yr.2)** indicating year on year change

Smoothed Model Test ⁽²⁾

Examines **2014/15 (Yr.3)** against **2014/15 (Sm)** indicating year on year change

⁽¹⁾ These would have been the models used for Gas Year 2014/15 if there had been no model smoothing

⁽²⁾ The corresponding alternative to the single year model

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Model Smoothing Results 2: Predictive Ability

- Aim: To assess the predictive ability of each model type (smoothed and single year) by comparing the difference of the actual CWV intercept from the most recent data set (i.e. 2014/15) to the single year model and the smoothed model. This is achieved by using variations in the CWV intercepts and calculating the overall RMS values
- Analysis:
 - Smoothed Year Model comparisons

Applicable Smoothed model for '14/15 (based on '11/12, '12/13, '13/14) compared to most recent dataset for '14/15
 - Single Year Model comparisons

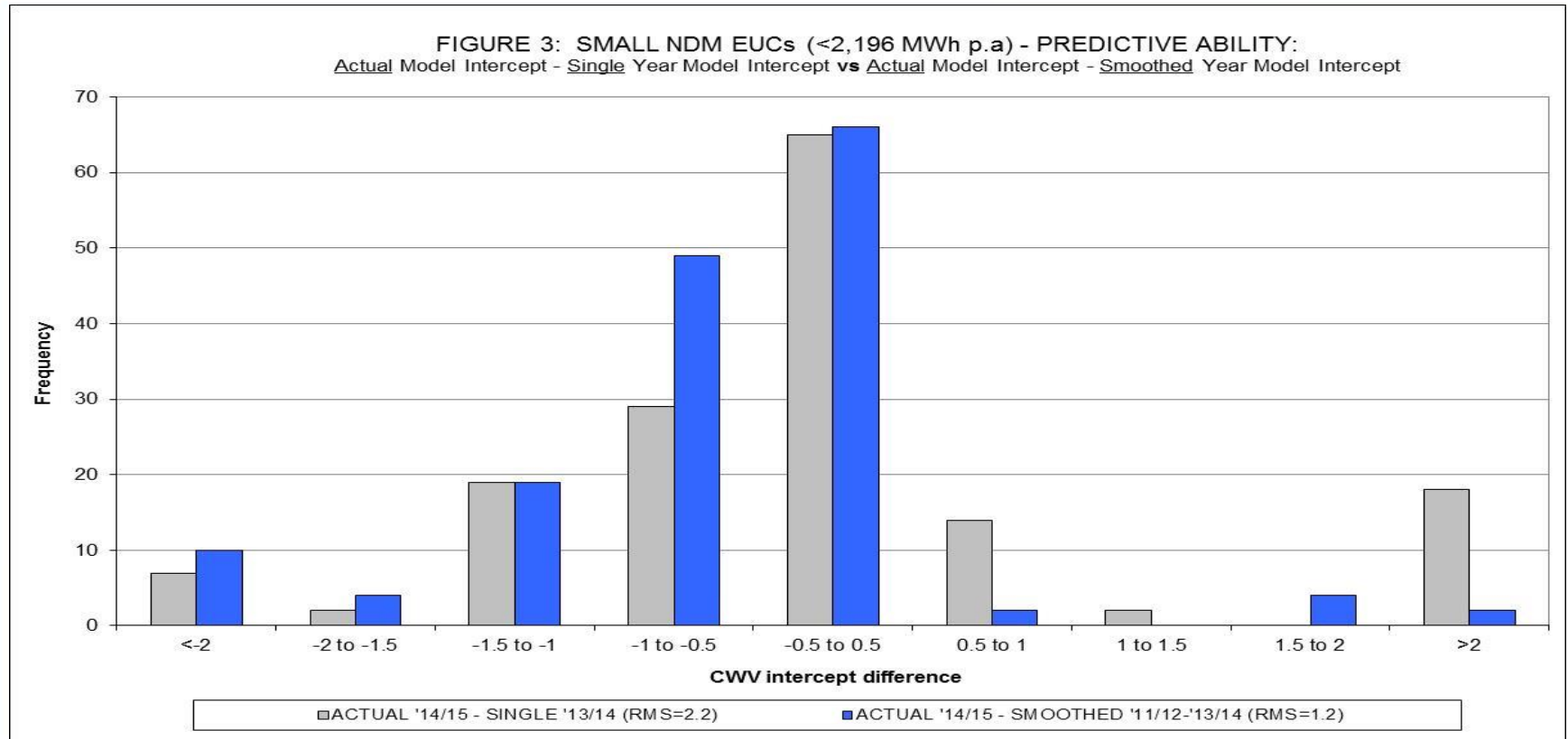
Single year model for '13/14 (*that would have been applied to '14/15*) compared to most recent dataset for '14/15

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Predictive Ability: Small NDM - All EUC Bands



- 156 Small NDM EUCs assessed
- Smoothed Model has similar spread of CWV intercept differences and lower RMS values

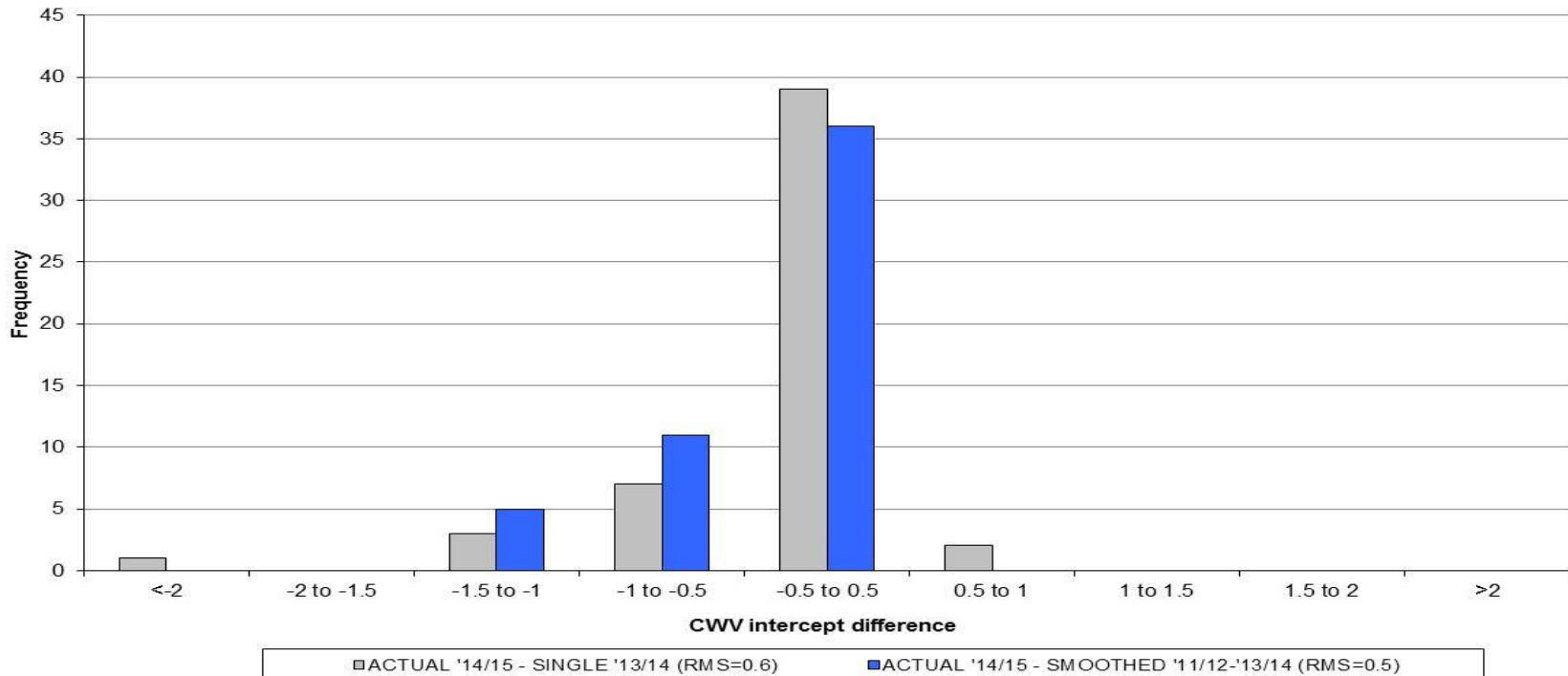
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Predictive Ability: Small NDM – Consumption Bands

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



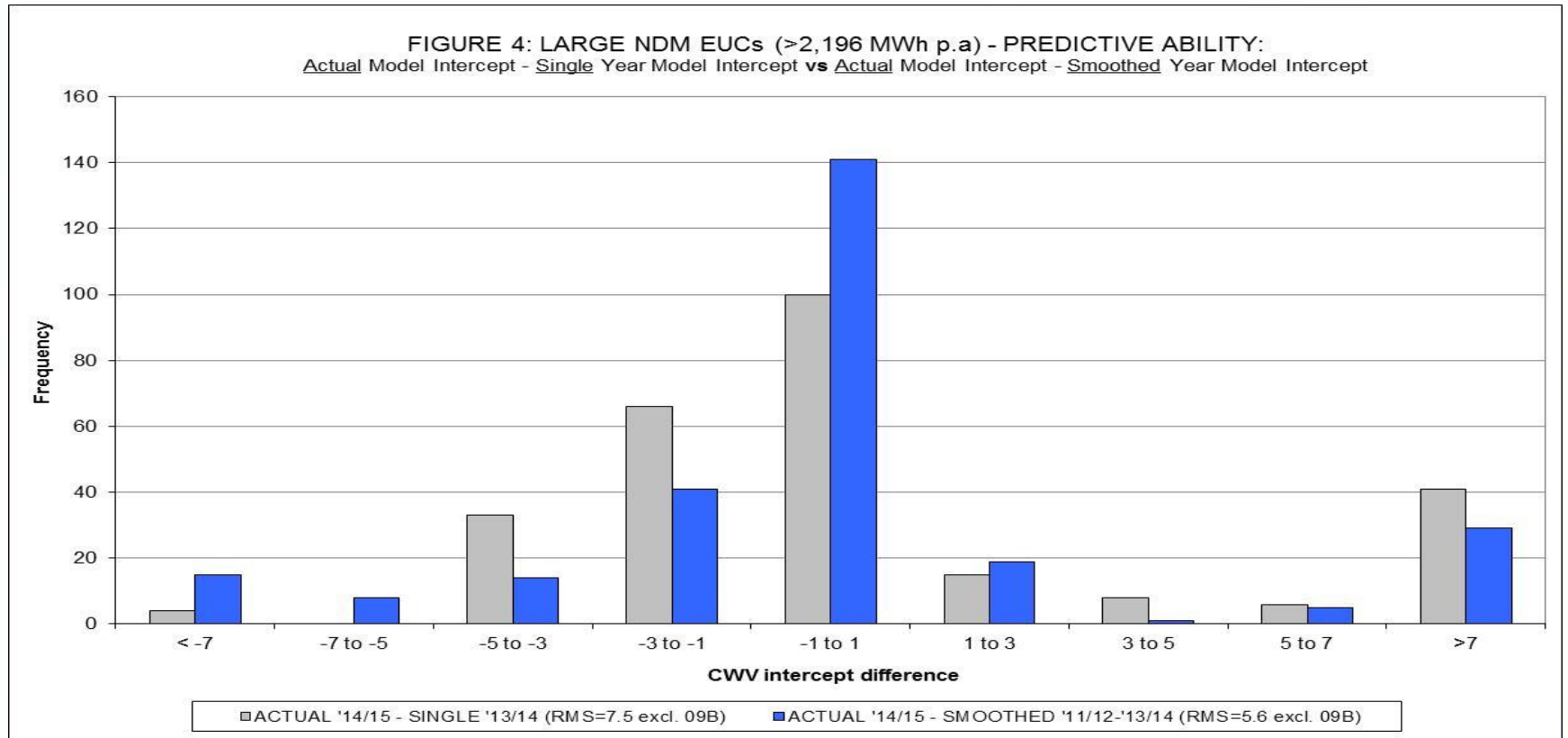
- 52 Small NDM EUCs assessed
- Smoothed Model has slightly narrower spread of CWV intercept differences and slightly lower RMS values

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Predictive Ability: Large NDM - All EUC Bands



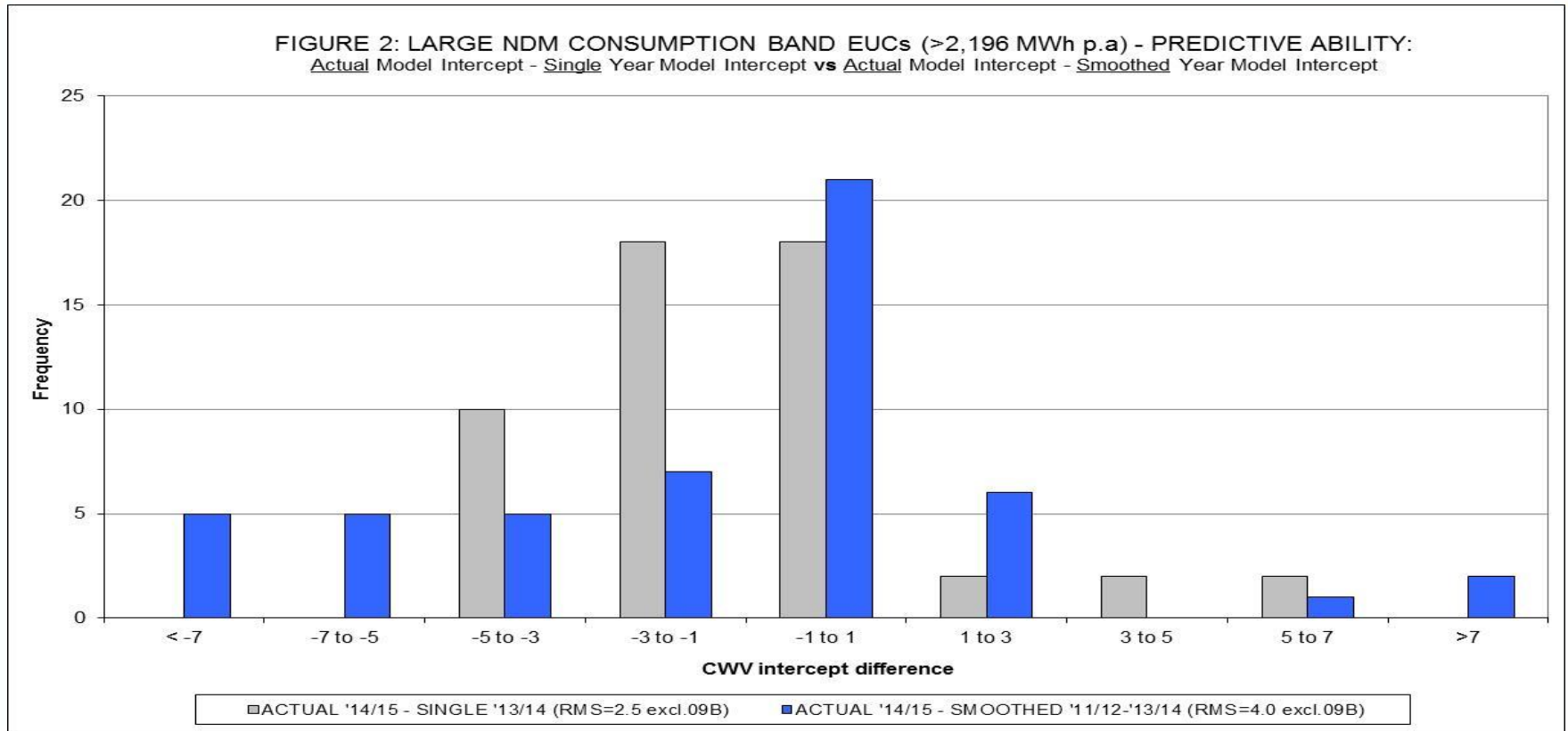
- 273 Large NDM EUCs assessed
- Smoothed Model has similar spread of CWV intercept differences with a lower RMS value

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Predictive Ability: Large NDM – Consumption Bands



- 52 Large NDM EUCs assessed (09B excluded)
- Single Year model has narrower spread of CWV intercept differences and a lower RMS value

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Model Smoothing Results 2: Predictive Ability

- For Small NDM whether analysing all EUCs or the consumption band EUCs the smoothed model for 2014/15 shows a narrower spread of CWV intercept differences, compared to the single year model, which is also reflected in the respective RMS values which are lower for the smoothed year model
- For Large NDM it is not quite as clear. When assessing all EUCs the smoothed model for 2014/15 shows a slightly better performance whereas for the consumption band EUCs the spread of CWV intercept differences are narrower and the RMS values smaller for the single year model
- 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 ability.

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Model Smoothing Results 3: CWV Intercept Trends (3yr)

- Aim: To identify any trends occurring in CWV intercepts between each year. This is achieved by comparing trends in the CWV intercept value for the 3 single year models constituting the 15/16 smoothed model.

Argument for single year models rather than smoothed could be strengthened if evidence of underlying trends

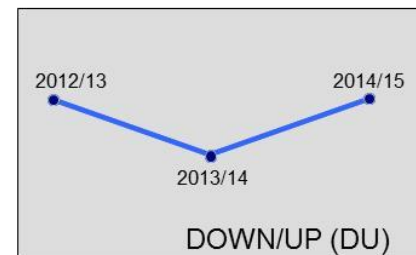
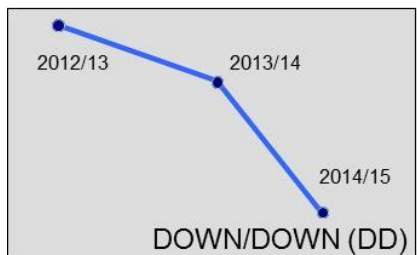
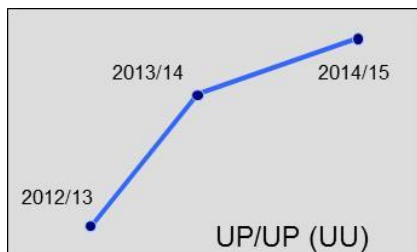
- Analysis:
 - CWV intercepts for '12/13 single year models
 - CWV intercepts for '13/14 single year models
 - CWV intercepts for '14/15 single year models
 - 5 possible outcomes when completing the analysis. Next slide summarises these....

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CWV Intercepts Trends: 3 year possible outcomes



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CWV Intercept Trends: Results of Analysis – 3 years

EUC	Type					Total
	UU	UD	DU	DD	F	
2012/13, 2013/14 and 2014/15 Analysis Years	11	135	136	109	38	429
2011/12, 2012/13 and 2013/14 Analysis Years	75	194	68	58	34	429
2010/11, 2011/12 and 2012/13 Analysis Years	132	117	115	26	39	429
2009/10, 2010/11 and 2011/12 Analysis Years	135	150	74	31	39	429
2008/09, 2009/10 and 2010/11 Analysis Years	90	85	161	54	39	429
2007/08, 2008/09 and 2009/10 Analysis Years	52	214	91	33	39	429
2006/07, 2007/08 and 2008/09 Analysis Years	129	123	101	37	39	429

Autumn 2015

Autumn 2014

Autumn 2013

Autumn 2012

Autumn 2011

Autumn 2010

Autumn 2009

- Table summarises the results for all EUCs for 3 year CWV intercept patterns
- Results highlighted are 'new' since last review of model smoothing in Autumn 2013
- Predominant effect is that of no consistent pattern ("UD" and "DU") - 271 in '15 and 262 in '14
- Rise seen in instances of a decreasing pattern ("DD") – 109 in '15
- For individual EUC and LDZ details see Table 2 in accompanying document

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Model Smoothing Results 3: CWV Intercept Trends (4yr)

- Aim: To identify any trends occurring in CWV intercepts between each year. This is achieved by comparing trends in the CWV intercept value for the 4 single year models
- Analysis:
 - CWV intercepts for '11/12 single year models
 - CWV intercepts for '12/13 single year models
 - CWV intercepts for '13/14 single year models
 - CWV intercepts for '14/15 single year models
- Analysis summarises possible outcomes as:
 - N: No consistent trend
 - D: Decreasing values
 - U: Increasing values
 - F: Flat or nearly flat models

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CWV Intercept Trends: Results of Analysis – 4 years

EUC	Type				Total
	N	D	U	F	
2011/12, 2012/13, 2013/14 and 2014/15 Analysis Years	372	13	6	38	429
2010/11, 2011/12, 2012/13 and 2013/14 Analysis Years	346	14	35	34	429
2009/10, 2010/11, 2011/12 and 2012/13 Analysis Years	308	7	75	39	429
2008/09, 2009/10, 2010/11 and 2011/12 Analysis Years	335	16	39	39	429
2007/08, 2008/09, 2009/10 and 2010/11 Analysis Years	363	5	22	39	429
2006/07, 2007/08, 2008/09 and 2009/10 Analysis Years	364	6	20	39	429
2005/06, 2006/07, 2007/08 and 2008/09 Analysis Years	356	18	16	39	429

Autumn 2015

Autumn 2014

Autumn 2013

Autumn 2012

Autumn 2011

Autumn 2010

Autumn 2009

- Table summarises the results for all EUCs for 4 year CWV intercept patterns
- Examined over 4 years the predominant effect is one of no consistent pattern across each LDZ and EUC band/WAR band
- Over 4 years only 19 EUCs of 429 showed a consistently downward / upward pattern
- For individual EUC and LDZ details see Table 3 in accompanying document

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Model Smoothing Results 4: Load Factor Trends

- Aim: To identify any trends occurring in the Load Factors for the individual years models

This is achieved by comparing the Load Factor values for the 4 single year models (constituting the 15/16 smoothed model and the year prior to this) in graphical format

- Analysis:
 - Load Factors '11/12 based on single year model
 - Load Factors '12/13 based on single year model
 - Load Factors '13/14 based on single year model
 - Load Factors '14/15 based on single year model

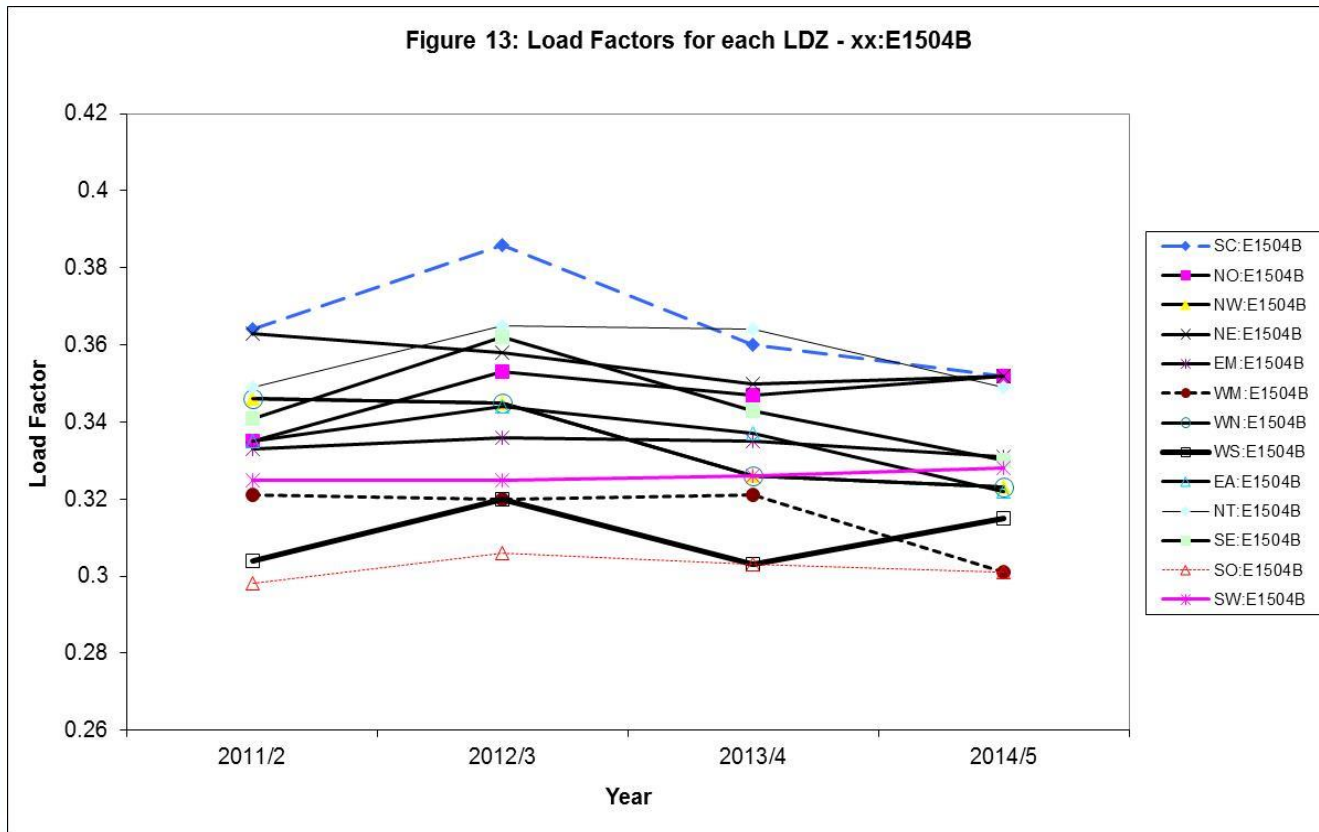
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Load Factor Trends: Results of Analysis – 4 years

Figure 13: Load Factors for each LDZ - xx:E1504B



- Graph shows the Load Factors for the single year models for 04B
- Examined over 4 years, generally the predominant effect is of no trend
- Over 4 years only 7 of 117 Consumption Band EUCs showed a consistently downward or upward pattern
- Figures 10-18 in accompanying document provide values for all Consumption Band EUCs

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Model Smoothing Review: Conclusions

- Principles of model smoothing:
 - Reduce year on year volatility
 - Not necessarily to improve model prediction
 - Necessary to review and assess if emerging trends are identified
- Current analysis consistent with results from previous analysis
 - Model smoothing does reduce year on year volatility overall
 - No strong evidence that the predictive ability is consistently better
 - No signs of emerging trends
- Results indicate current methodology of using model smoothing over 3 years is appropriate and fit for purpose
- Are TWG happy to provide a recommendation to DESC to continue with 3 year model smoothing for the Spring 2016 and Spring 2017 analysis ? Next review Autumn 2017 ?

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