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Demand Estimation Sub Committee
Review of Summer Modelling performance

15th November 2016

Background

- Each summer DESC are asked to consider / review the work plan for the upcoming Autumn / Winter period. This consists of:
  - Standard regular work items performed year on year
  - Adhoc work areas which naturally get raised through discussions at DESC and/or DESC TWG and captured by Xoserve on an adhoc work areas log.
- Xoserve maintain the list to ensure it is up to date with any progress on listed items and recording any new items raised in the past 12 months
- DESC have the responsibility of reviewing the list and prioritising those it wishes TWG to focus on during the next Autumn and Winter period in addition to the standard work plan items
- The next 2 slides summarise the standard work plan items and the adhoc work items (approved by DESC at its meeting on 26th July) for the upcoming Autumn / Winter period

Standard Work Plan Items – Autumn/Winter 16/17

- Algorithm Performance for Gas Year 2015/16 - NDM sample analysis strand:
  - NDM sample validation (prep. for analysis)
  - Shipper sample validation (if available)
  - Assessment of sample consumption vs allocation
- Spring Approach 2017 preparations
  - Approach document approved
  - Back runs
  - Updates to modelling systems
- Establish ‘Catch-up’ schedule for Spring sample data collection

Adhoc Work Plan Items – Autumn/Winter 16/17

- In addition to standard work plan items DESC approved the following areas as priorities for this Autumn / Winter work schedule
  - Support to UK Link replacement, including ongoing simulation of UG levels
  - Establish process for Algorithm Performance measures for 'new world' algorithm
  - Update to modelling systems to accommodate new UK Link data structure
  - Consider possible measures to improve algorithm performance over summer (encompassing adhoc work items 'TWG 23/05/12' and 'TWG 26/06/13')

Adhoc Work Plan Items – Autumn/Winter 16/17

- Consider possible measures to improve algorithm performance over summer (encompassing adhoc work items ‘TWG 23/05/12’ and ‘TWG 26/06/13’)
  - TWG 23/05/12
    Further consideration given to parameters / tests used for defining warm weather cut-off models
  - TWG 26/06/13
    Review actual sample consumption versus summer profiles in order to try and improve allocation process during summer months
- This presentation provides a progress update of the work carried out so far by Xoserve, in relation to the above

Analysis Guidelines

- Objective:

  To investigate whether the accuracy of the NDM modelling over the summer months can be improved whilst ensuring the winter performance is not adversely affected

  To ensure any improved accuracy in the NDM modelling also flows through to reducing the volatility of the Unidentified Gas values during the same period

- Scope:

  The analysis will review the current modelling approach and identify the relevant parameters relating to the summer period which can be adjusted by the user within the existing modelling system

Approach to Analysis

- 1) Collate results for the current modelling profiles in order to have a baseline to compare to when trialing changes. Achieve this by…
  - 1.1) Reviewing previous algorithm performance results (NDM sample strand) over recent gas years to confirm any patterns/trends in summer across the bands
  - 1.2) Reviewing previous similar DESC analysis and its conclusions to confirm why current parameters / test criteria are used
  - 1.3) Reviewing results from simulated UG analysis in order to provide additional understanding on how demand models are performing
  - 1.4) Seeking feedback from DESC/TWG for any additional information / evidence they have that could assist with investigations

Approach to Analysis

- 2) Understand what changes in approach are possible within existing modelling system. Achieve this by…
  - 2.1) Confirming all parameters available within existing modelling system influencing summer profiles e.g. summer reductions, cut offs, holidays
- 3) Create new profiles using different parameters and test them by replicating the NDM algorithm and comparing to the sample data over a number of years. Achieve this by…
  - Perform modelling using different parameters to create revised ALPs/DAFs
  - Re-run algorithm performance NDM sample strand for 3 gas yrs (12/13-14/15)
  - Compare results to ‘base-lined’ position
  - Output presented similar to that provided in Section 12 of the NDM report

Results for current modelling profiles

1.1) Review previous algorithm performance

Results of Analysis

- *1.1) Reviewing previous algorithm performance results (NDM sample strand) over recent gas years to confirm any patterns/trends in summer across the bands*

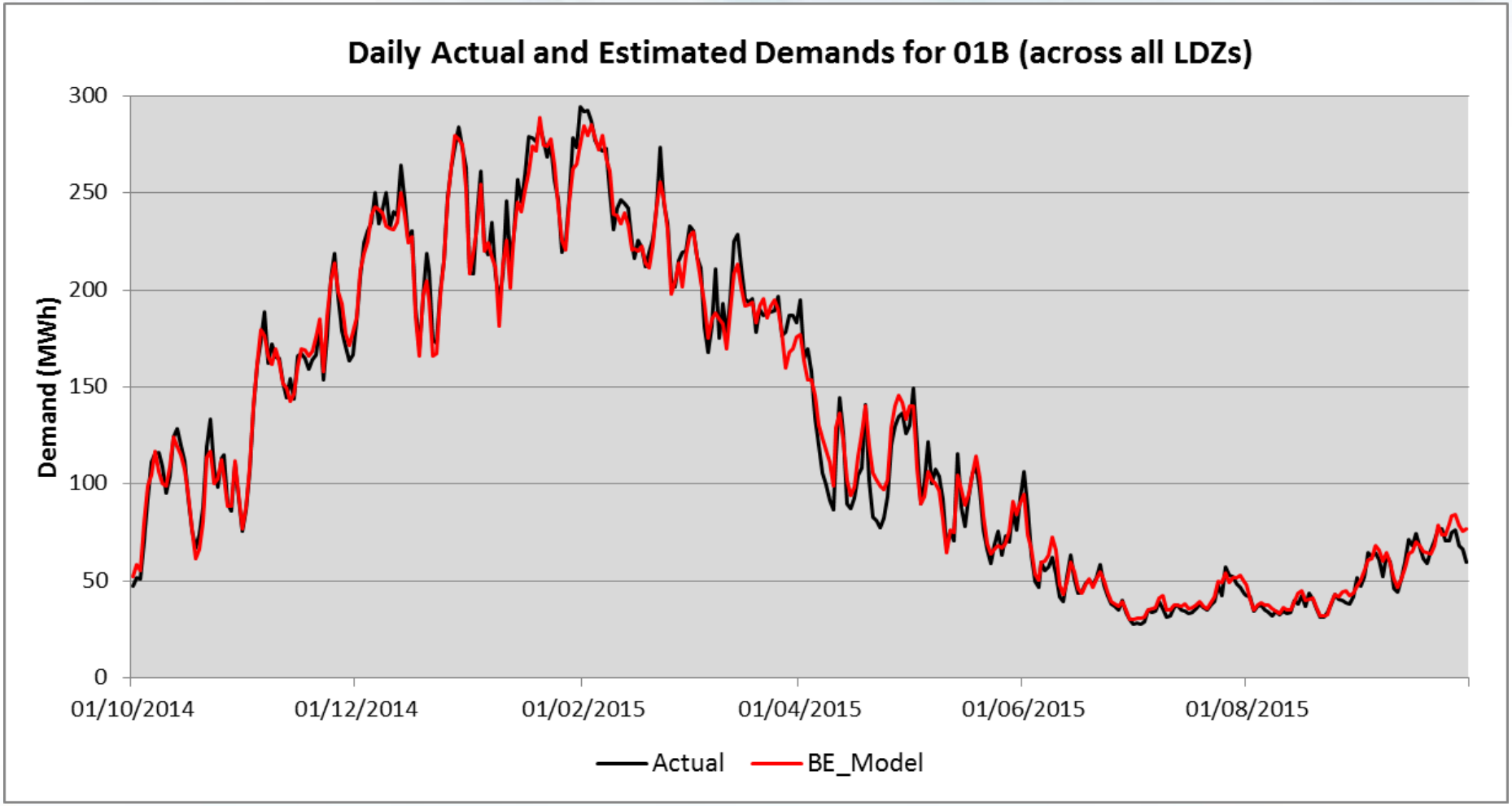
  - Initial investigations has focused on the 01B sample results as at a population level this represents approx. 75% of the NDM market

  - Daily sample data collected for all LDZs (except WN) for GY 12/13, 13/14 & 14/15 and has been compared to bottom up estimate calculation ('*BE Model')* that is due to go live when Project Nexus is implemented, namely:

    $SPD_t = ((AQ/365) \times ALP_t \times (1 + (DAF_t \times WCF_t)))$

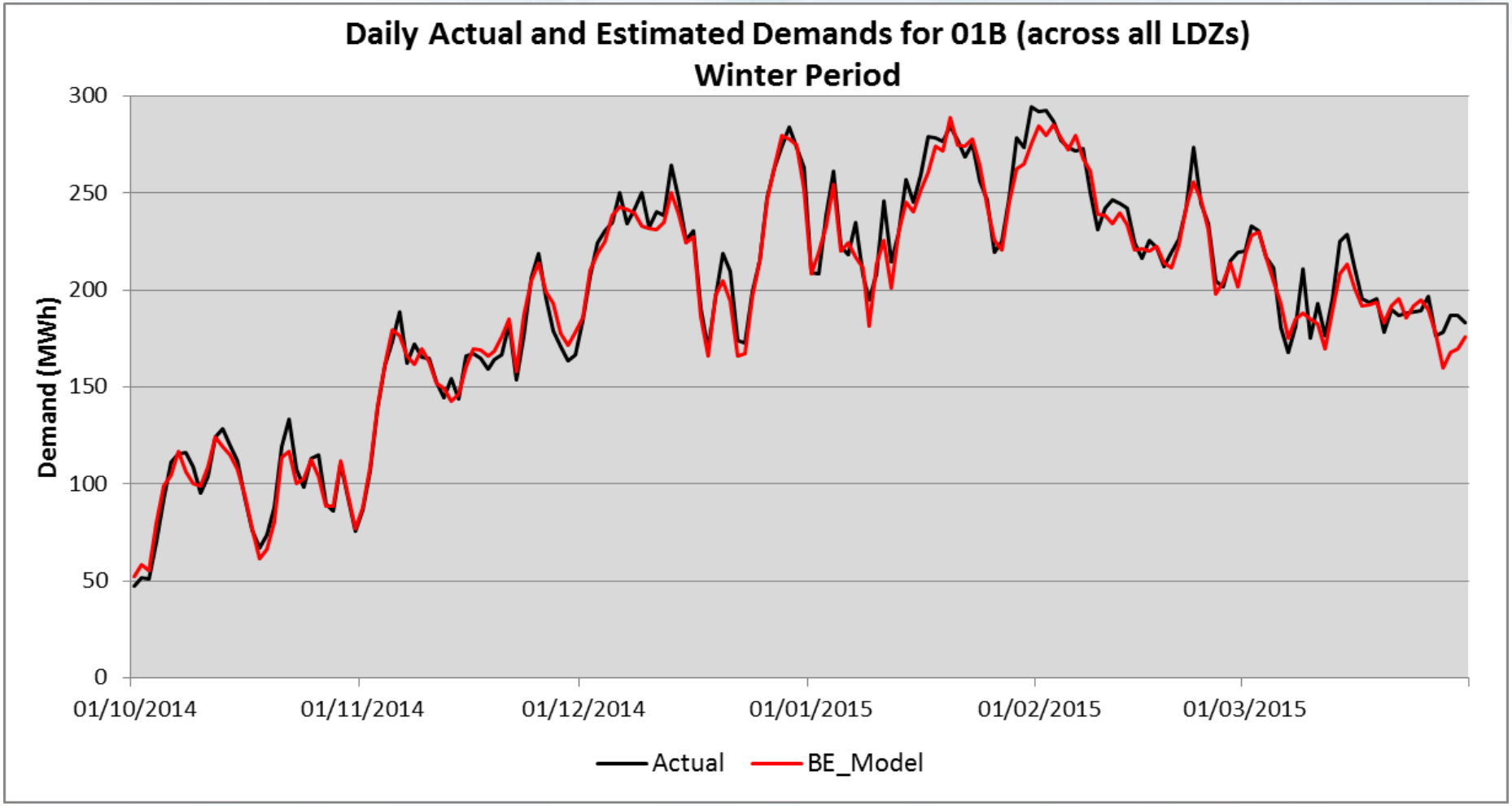
  - For the avoidance of doubt, all parameters used are on the new seasonal normal basis (effective from October 2015) and the WCF and DAF have been calculated using the formulas effective from Project Nexus implementation

01B: Daily Actual vs Estimate for Gas Year 14/15



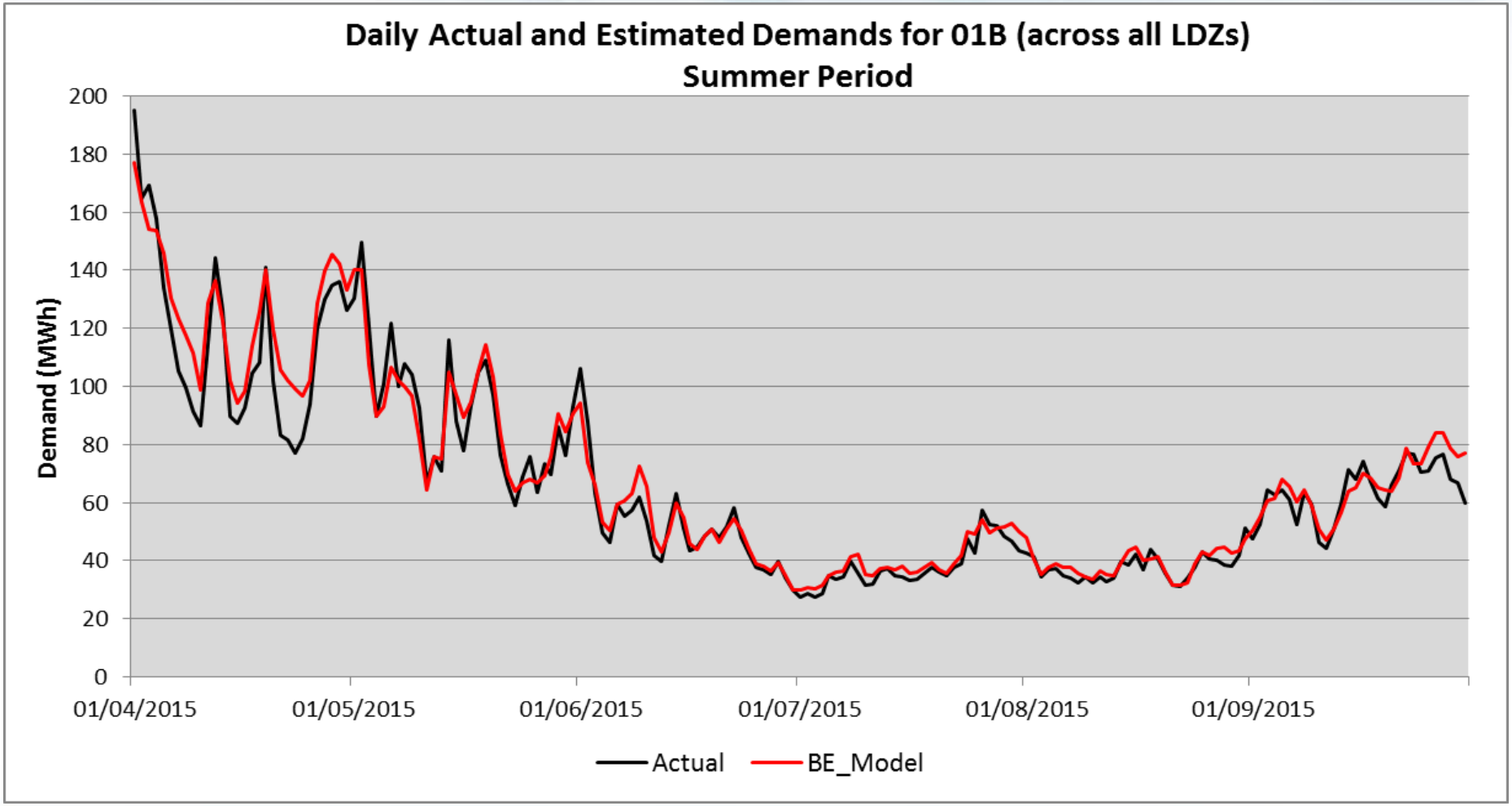
- Aggregate of all 01B sample data (12 LDZs) for Gas Year 2014/15 - also exists for Gas Year 2012/13 and 2013/14

01B: Daily Actual vs Estimate for Gas Year 14/15



- Aggregate of all 01B sample data (12 LDZs) for winter period in Gas Year 2014/15

01B: Daily Actual vs Estimate for Gas Year 14/15

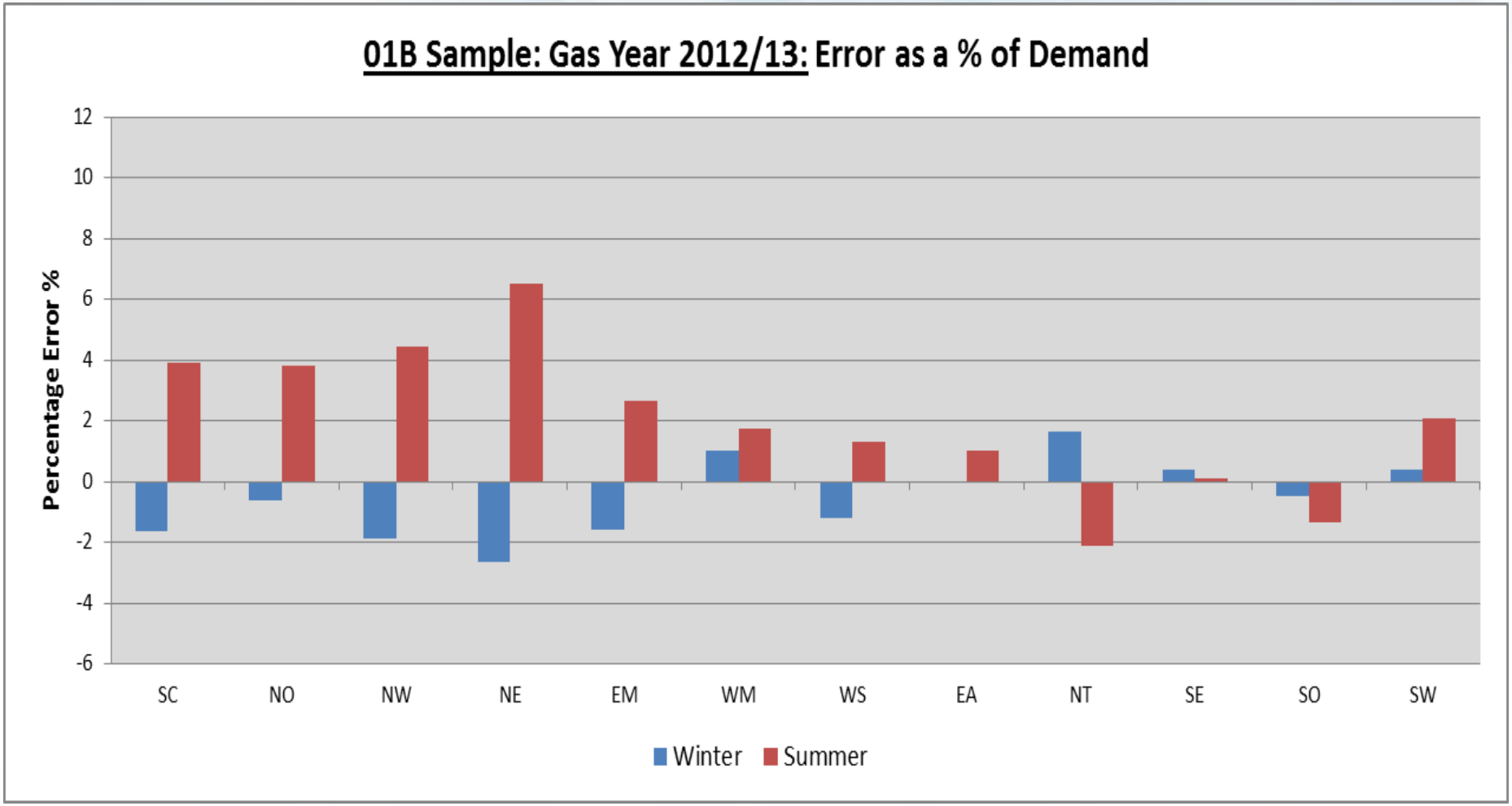


- Aggregate of all 01B sample data (12 LDZs) for summer period in Gas Year 2014/15

Analysis of differences

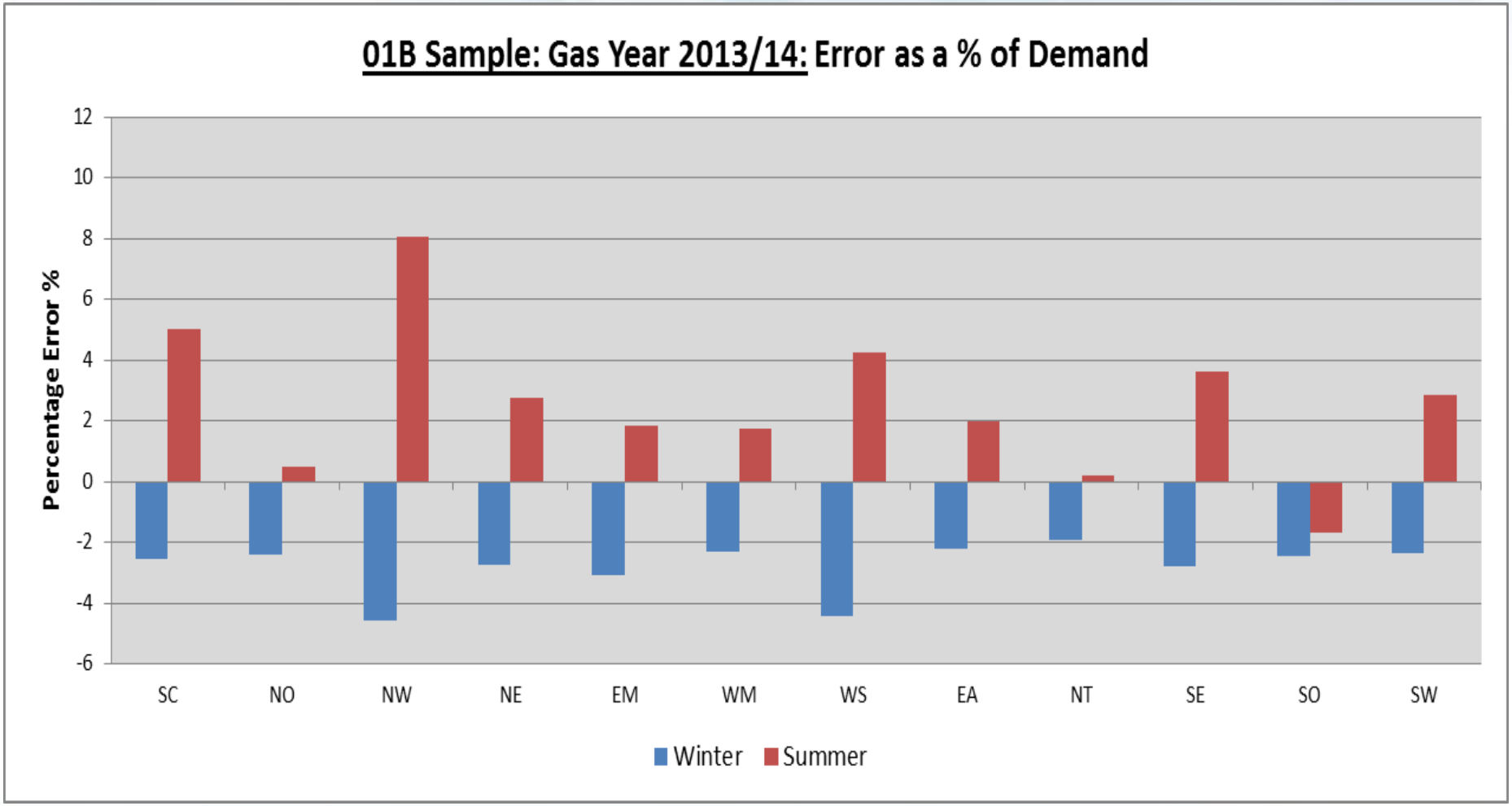
- The differences between the actual daily consumption and the bottom up estimate (Actual – Estimate) have been analysed in various aggregations i.e. gas year, season, month, etc
- A positive % difference represents an over allocation from the estimate
- A negative % difference represents an under allocation from the estimate
- Summer is defined as April to September and Winter is defined as October to March, however further detailed results are provided at a monthly level as well as a comparison at a daily level

01B: LDZ results by season for Gas Year 2012/13



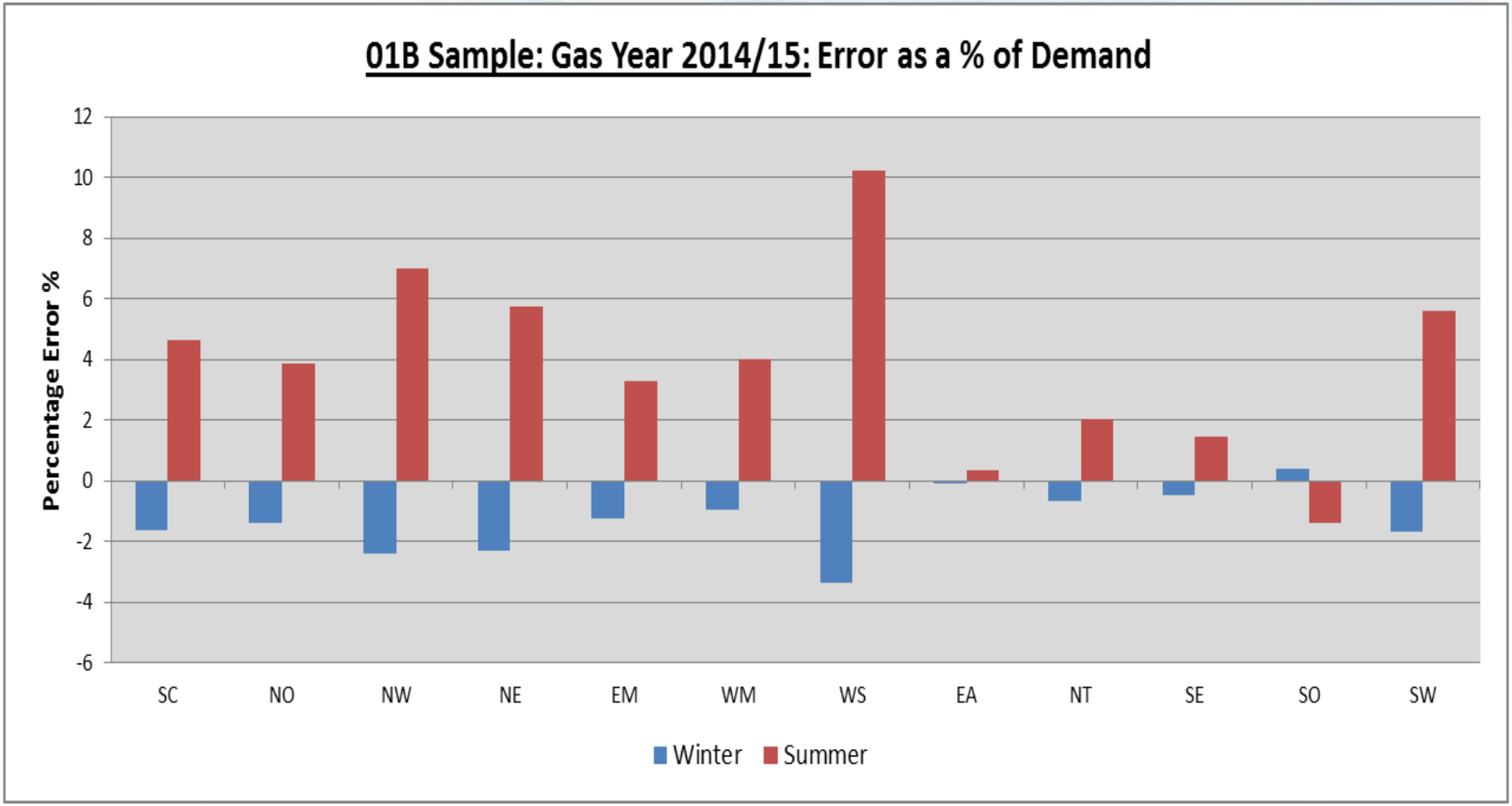
- For Gas Year 2012/13 results show an over allocation in the summer and under allocation in the winter for majority of LDZs (7 of 12 LDZs)
- All LDZs: Under Allocation in Winter (-0.58) and Over Allocation in Summer (2.02)

01B: LDZ results by season for Gas Year 2013/14



- For Gas Year 2013/14 results show an over allocation in the summer and under allocation in the winter for majority of LDZs (11 of 12 LDZs)
- All LDZs: Under Allocation in Winter (-2.80) and Over Allocation in Summer (2.53)

01B: LDZ results by season for Gas Year 2014/15

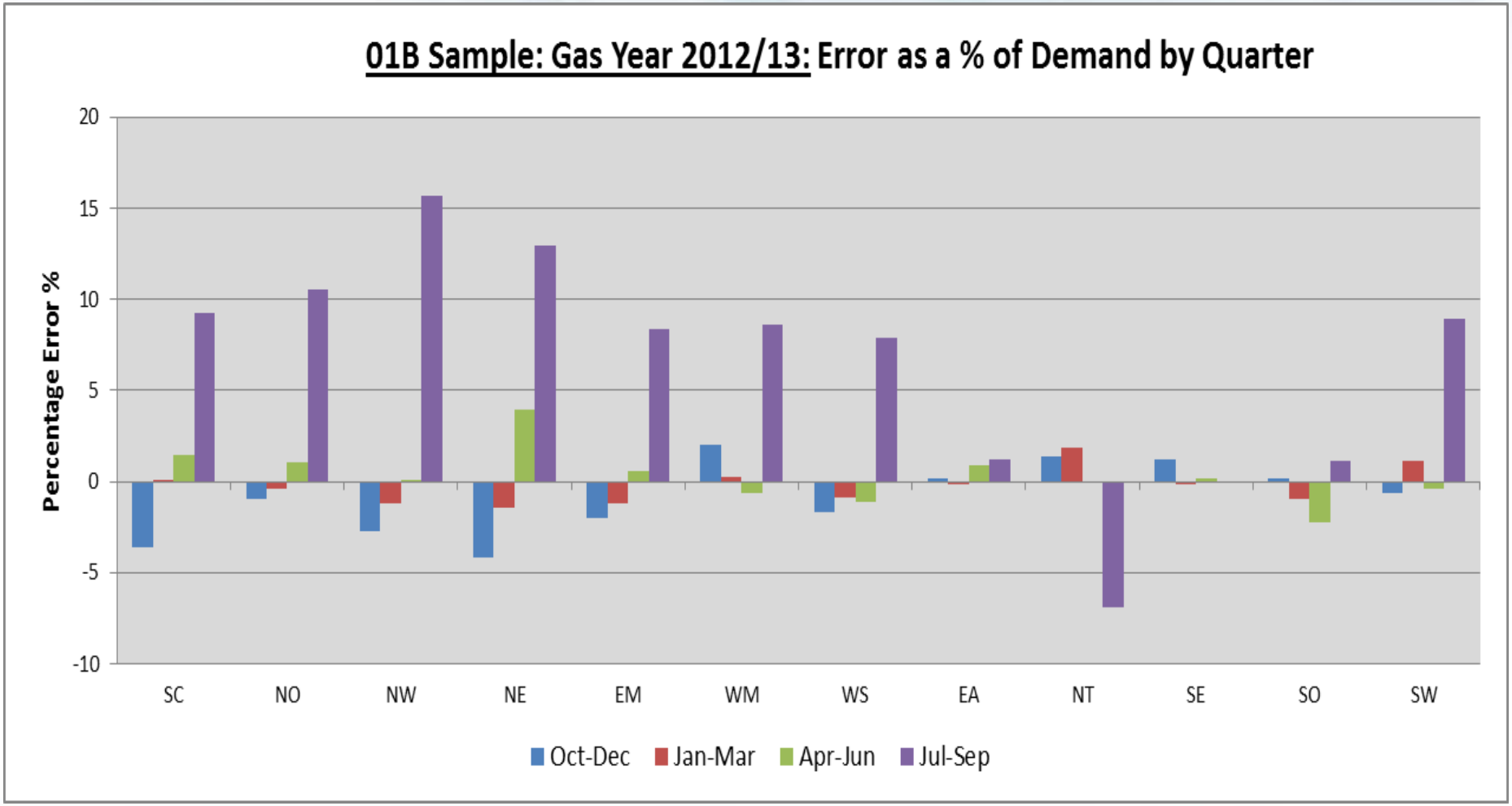


- For Gas Year 2014/15 the results show an over allocation in the summer and under allocation in the winter for majority of LDZs (11 of 12 LDZs)
- All LDZs: Under Allocation in Winter (-1.28) and Over Allocation in Summer (3.82)

Analysis of differences - commentary

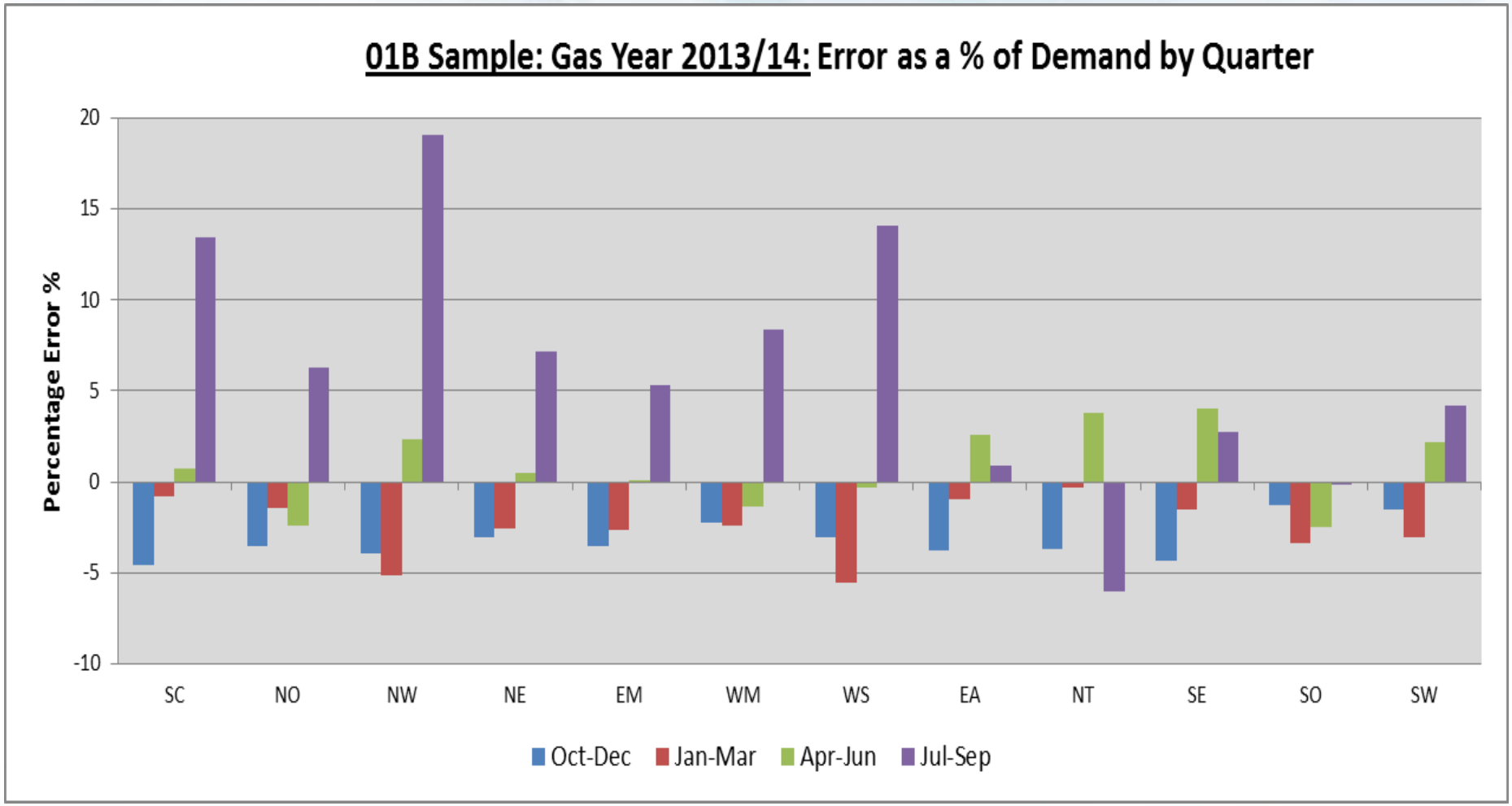
- Over the 3 years analysed there is a clear trend of the models over allocating during the summer and under allocating during the winter
- The percentage error in the summer appears bigger than in the winter, in practice the volume of energy difference is likely to be lower
- Actual summer demands are lower than in the winter which can mean percentage errors are greater
- Further breakdown of the differences by quarter was analysed in order to pin point any specific periods……

01B: LDZ results by Quarter for Gas Year 2012/13



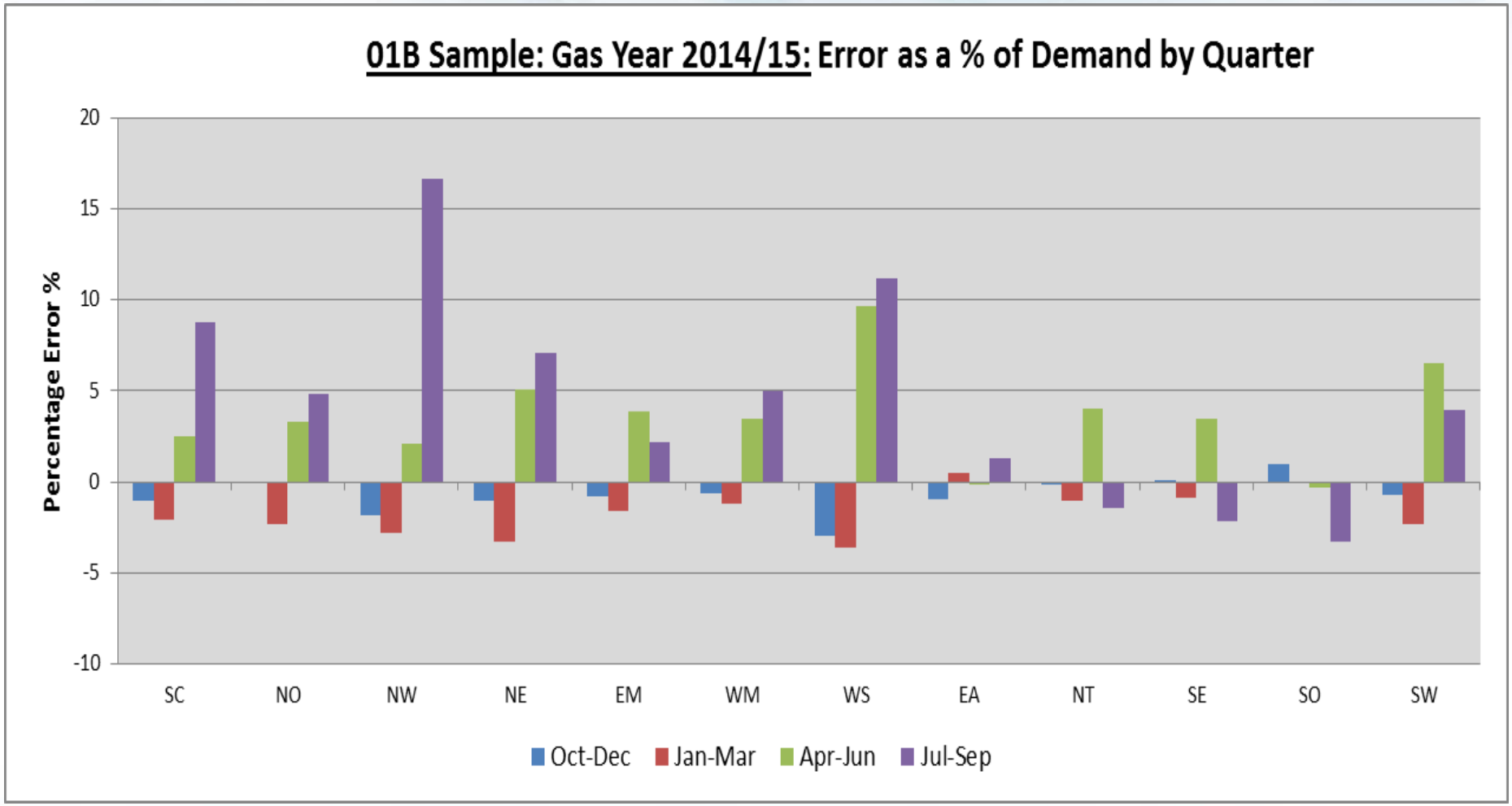
- July to September quarter displays biggest differences for majority of LDZs (10 of 12)
- All LDZs: Oct-Dec (-1.00); Jan-Mar (-0.26); Apr-Jun (0.33); Jul-Sep (6.30)

01B: LDZ results by Quarter for Gas Year 2013/14



- July to September quarter displays biggest differences for majority of LDZs (9 of 12)
- All LDZs: Oct-Dec (-3.19); Jan-Mar (-2.47); Apr-Jun (0.73); Jul-Sep (6.06)

01B: LDZ results by Quarter for Gas Year 2014/15

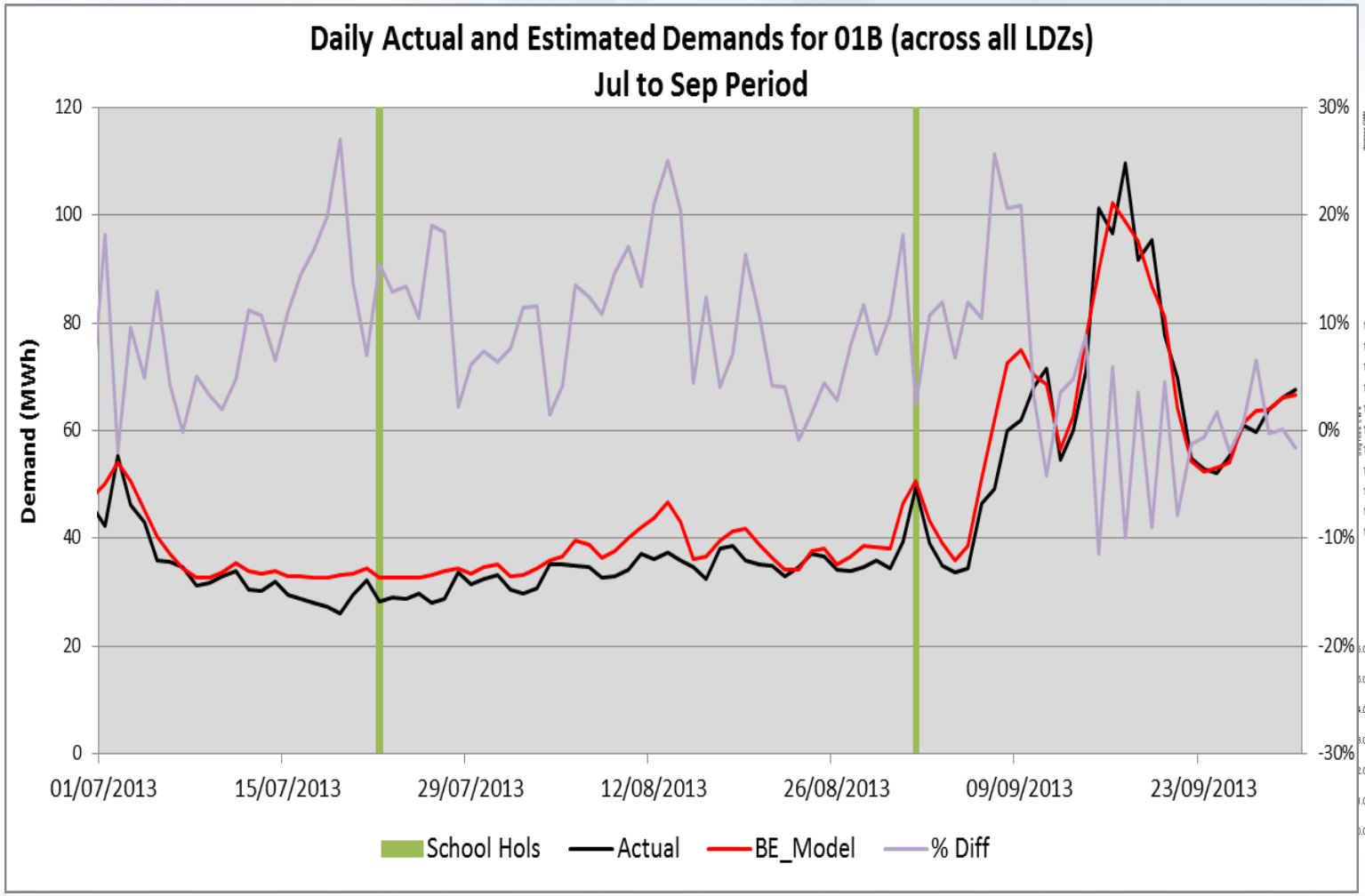


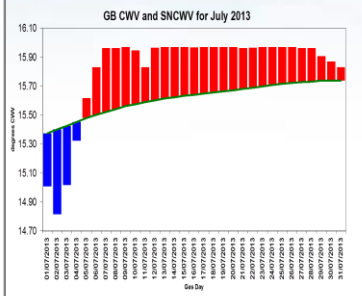
- July to September quarter displays biggest differences for majority of LDZs (8 of 12)
- All LDZs: Oct-Dec (-0.75); Jan-Mar (-1.67); Apr-Jun (3.47); Jul-Sep (4.46)

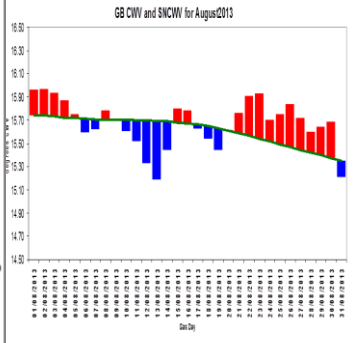
Analysis of differences - commentary

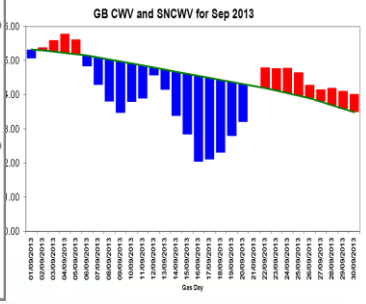
- Over the 3 years analysed it appears that the July to September quarter is where the biggest differences are seen
- There appears to be a split observed in the results. For LDZs EA, NT, SE and SO there appears different outcomes to the other LDZs, in terms of accuracy and trends
- Further breakdown of the July to September period was analysed showing the daily differences
- Appendix at the end of the presentation shows all the results by month for further breakdown

01B: Daily Actual vs Estimate for Jul'13 to Sep'13









- Mini charts provide context in terms of weather experienced
- Approximate dates of school hols added for information

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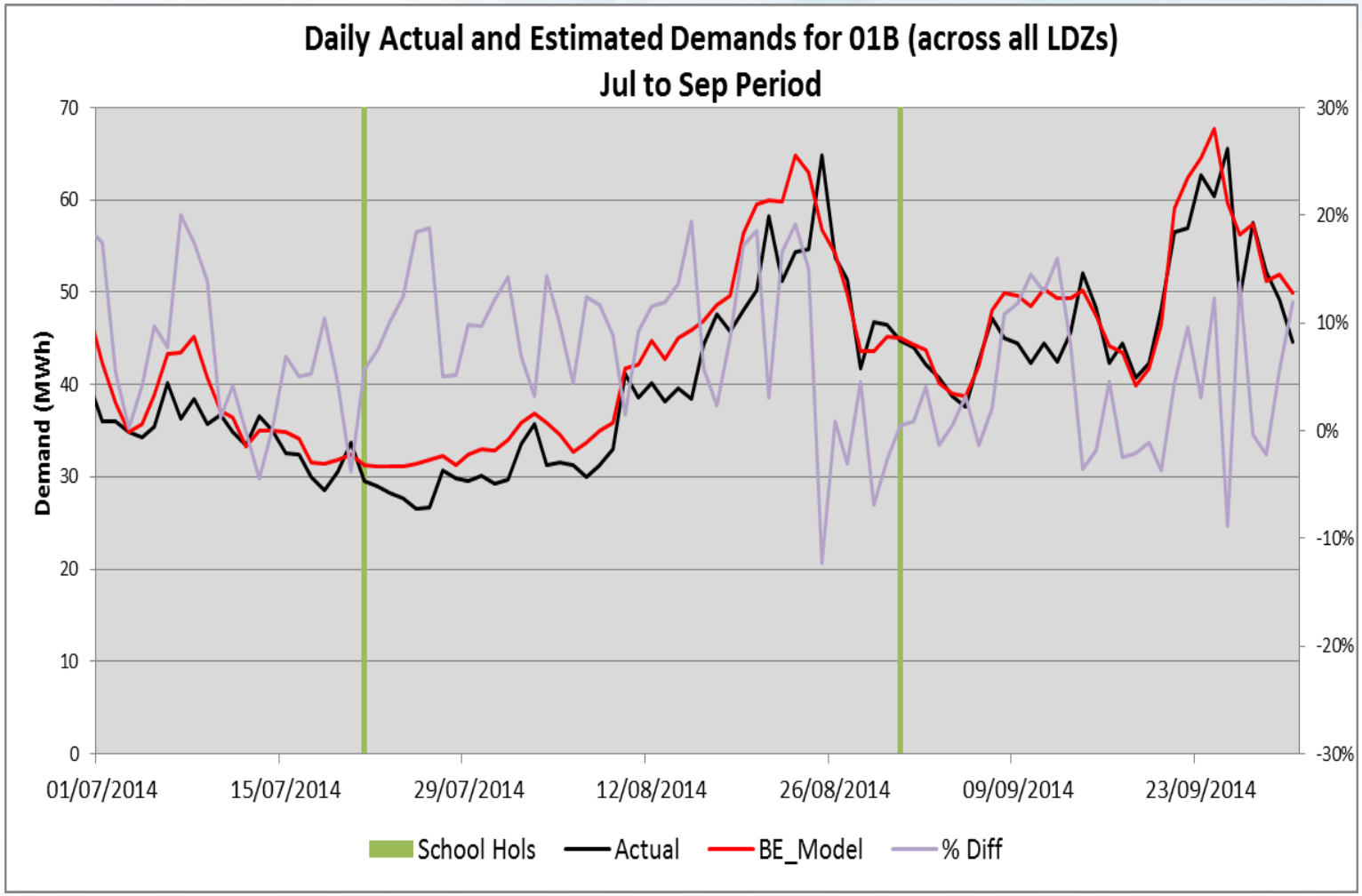
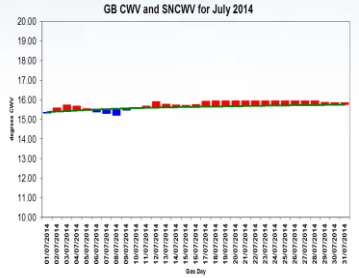
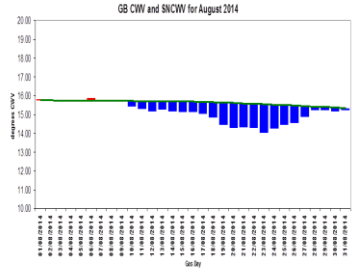
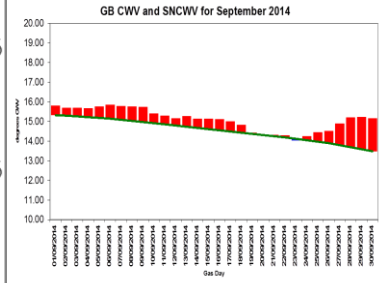
01B: Daily Actual vs Estimate for Jul'14 to Sep'14









- Mini charts provide context in terms of weather experienced
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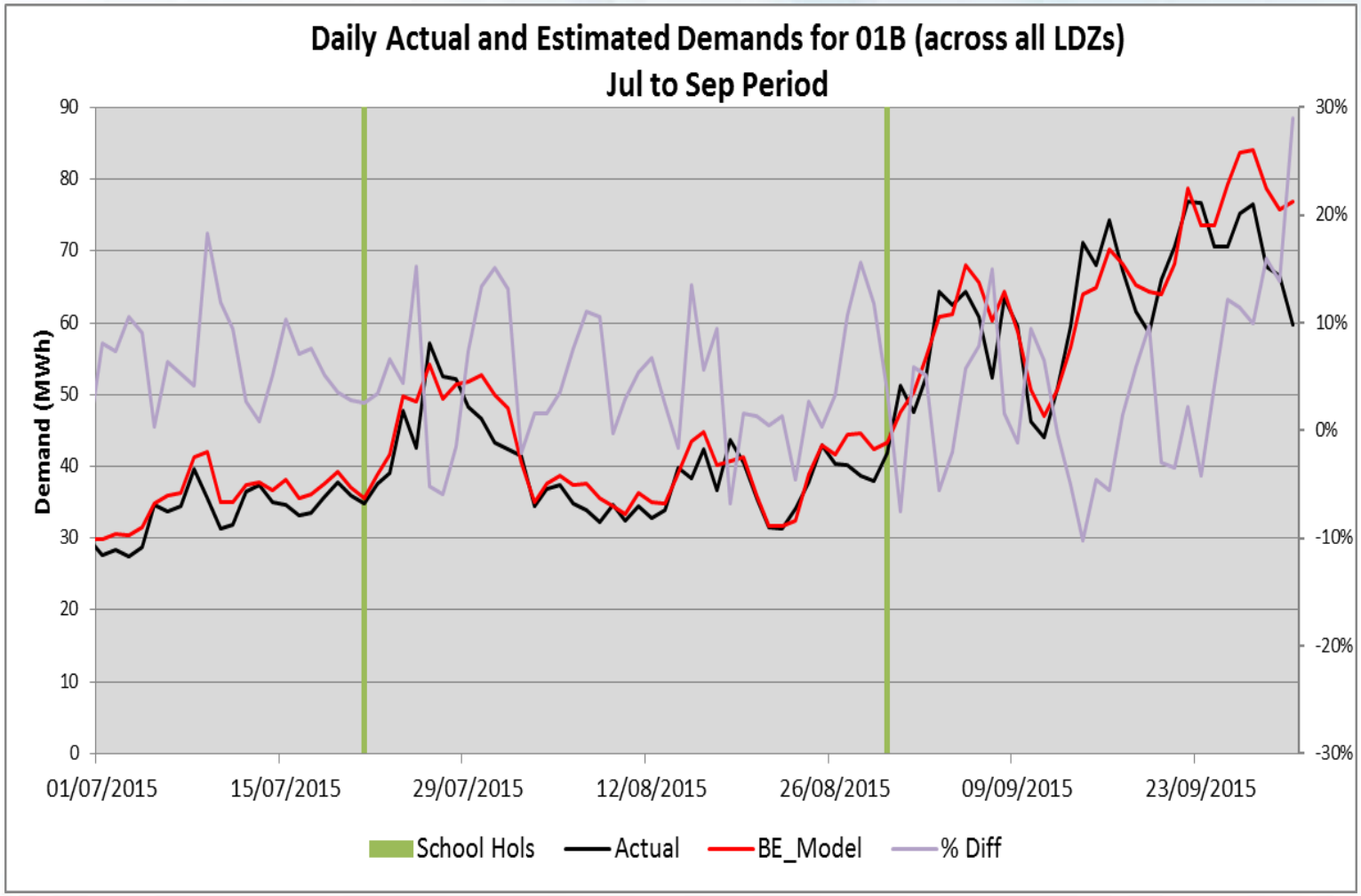
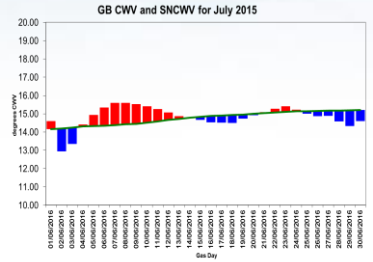
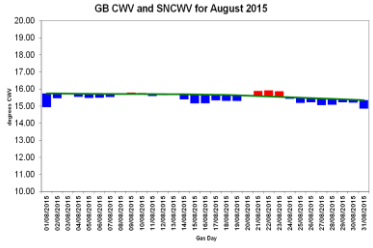
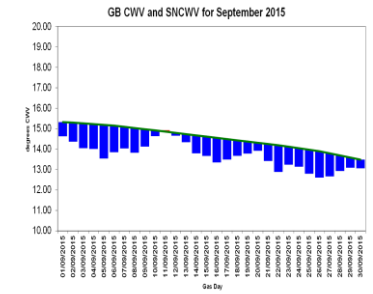
01B: Daily Actual vs Estimate for Jul'15 to Sep'15









- Mini charts provide context in terms of weather experienced
- Approximate dates of school hols added for information

Conclusions

- Over the 3 years analysed it is clear that for 01B the models are over allocating in the summer and under allocating in the winter
- This could be due to the profiles being too ‘flat’ meaning they need to become ‘peakier’ i.e. more demand in the winter and less in the summer
- It could also be as a result of the weather sensitivities from the model not representing the actual behaviour at certain times of the year or under particular scenarios
- We need to investigate options available within the existing modelling approach which could improve the overall performance

Results for current modelling profiles

1.2) Review previous similar DESC analysis

Results of previous analysis

- *1.2) Reviewing previous similar DESC analysis and its conclusions to confirm why current parameters / test criteria are used*

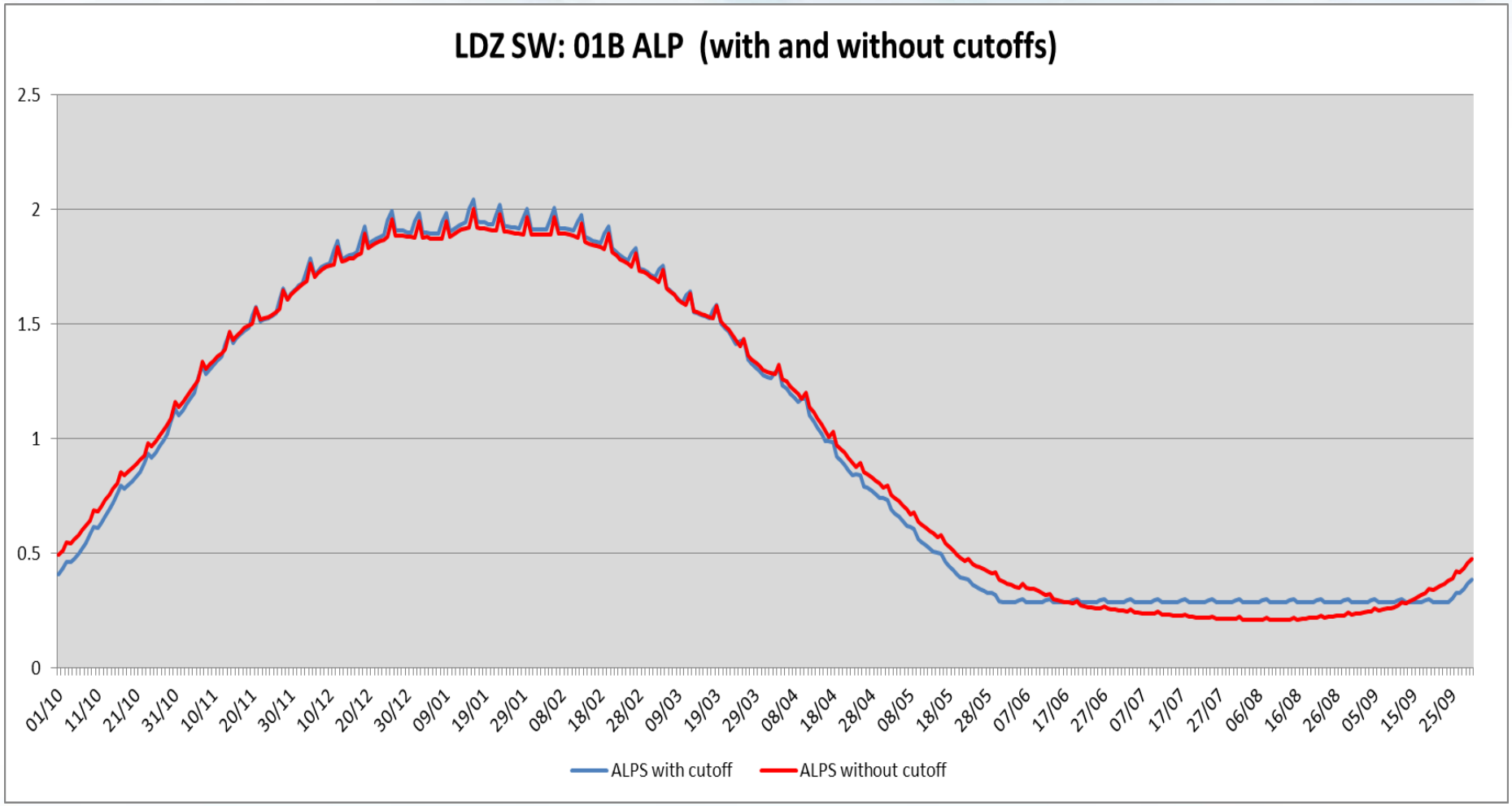
  - At a DESC meeting in December 2003 it was agreed that EUC models in Bands 01B and 02B (less than 293 MWh pa) should not have summer cut-off criteria applied. This was implemented from Spring 2004 onwards

    This approach was intended to improve summer scaling factor instability

    This followed analysis which showed that when a cut-off is applied the resultant DAFs are reduced closer to zero which often were not appropriate for the weather conditions that actually prevail on those summer days

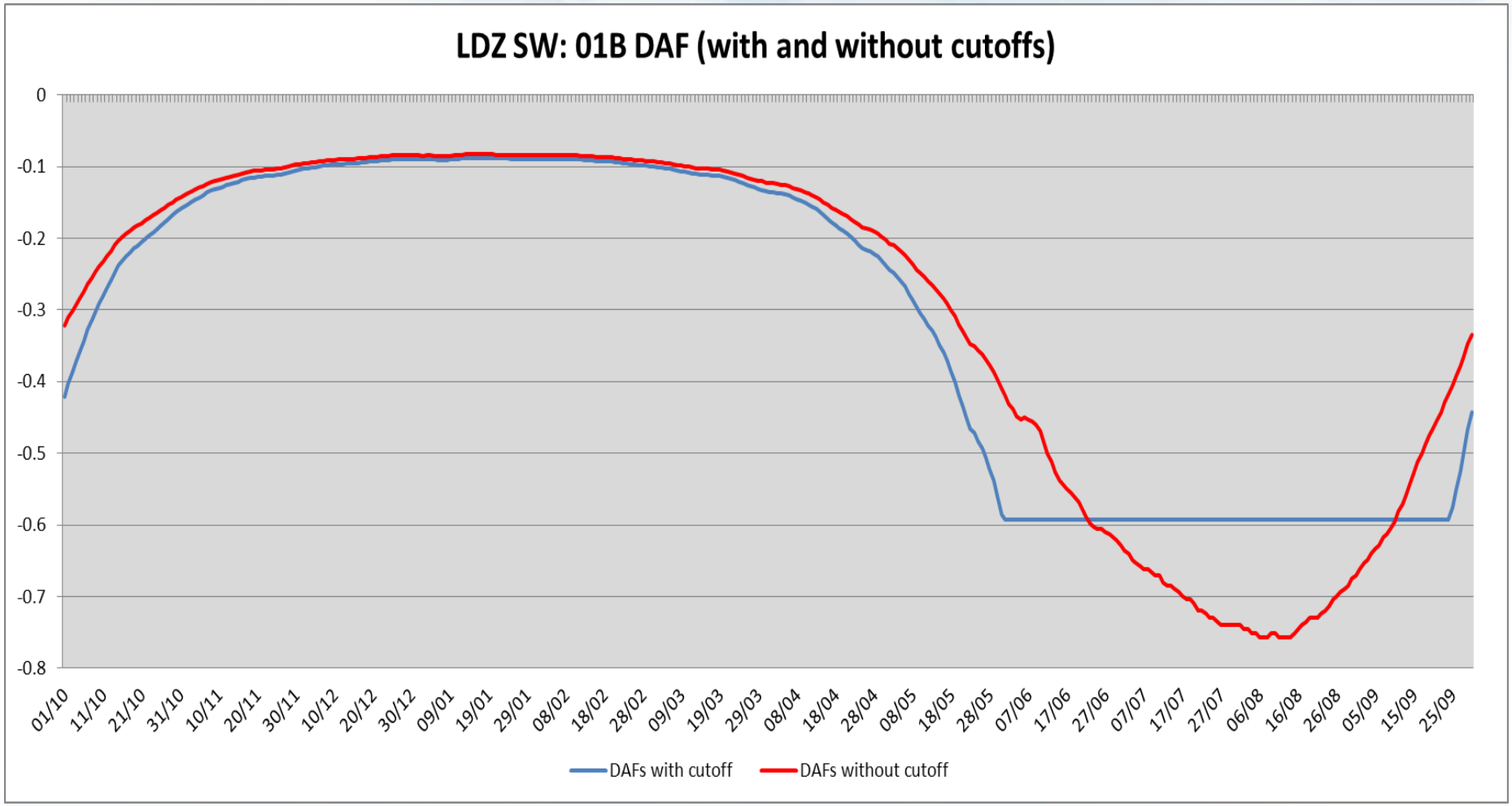
  - As the current models appear to be over allocating it would seem unwise to reintroduce an additional restriction to the models which mean the forecast demand is not allowed to drop below a certain level ?

Previous analysis – 01B ALP with / without cut offs



- Based on single year of sample data (Apr 15 to Mar 16)
- Results of a smoothed 3 year ALP may be different depending on other 2 years

Previous analysis – 01B DAF with / without cut offs



- Based on single year of sample data (Apr 15 to Mar 16)
- Results of a smoothed 3 year DAF may be different depending on other 2 years

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Results of previous analysis

- *1.2) Reviewing previous similar DESC analysis and its conclusions to confirm why current parameters / test criteria are used*

  - At a DESC meeting in November 2010 it was agreed to continue with the approach of treating holidays like any other day in the regression models for 01B EUCs. This means that the Monday to Thursday core model does not exclude any holiday periods, as defined by the modelling system

    The analysis revealed an inconsistent pattern of holiday factors across the LDZs and it was felt the best approach was to recommend no change

  - As the summer does include holiday periods it is possibly advisable to check whether this approach for 01B EUCs is still valid by reviewing more recent years' sample data ?

Results of previous analysis

- *1.2) Reviewing previous similar DESC analysis and its conclusions to confirm why current parameters / test criteria are used*

  - There has been various analysis in the past reviewing the 0-73.2 consumption range and whether more appropriate break points exist – see below:

    - At a DESC meeting in November 2007 results of an investigation of splitting the range at 20 MWh pa and 30 MWh pa was presented
    - At a DESC meeting in November 2008 results of an investigation of dividing the range 0-293 MWh pa at different breakpoints (i.e. other than 73.2)
    - At a DESC meeting in February 2012 results of an investigation of splitting the range at 10 MWh pa and 20 MWh pa was presented

  - In all cases there was no compelling evidence for changing the existing band

  - As analysis was some time ago it may be worth looking into as a future adhoc work area but cannot be achieved in time for Spring 2017

Results of previous analysis

- *1.2) Reviewing previous similar DESC analysis and its conclusions to confirm why current parameters / test criteria are used*

  - It has not been possible to find out when and why the current parameters for summer reductions are selected. It is likely that these have not been changed or reviewed for a long time

  - Summer reductions are introduced when demand falls away to lower than expected values. The initial test for the individual model is 5%. The test for the smoothed model is 10%

  - The current period used for assessing summer reductions is from the Spring bank holiday at the end of May to the final Sunday in September

  - The above criteria may be worth investigating to see if these tests still seem sensible ?

Results for current modelling profiles

1.3) Review results from simulated UG analysis

Unidentified Gas

- *1.3) Reviewing results from simulated UG analysis in order to provide additional understanding on how demand models are performing*

  - There is a new concept of daily Unidentified Gas (UG) in the post Nexus regime

  - For background info on UG please refer to the DESC presentation (16th Feb 2016)

  - We believe there may be an association between allocation accuracy and the simulated levels of UG. The next few slides will explore if there is any relationship between the two variables

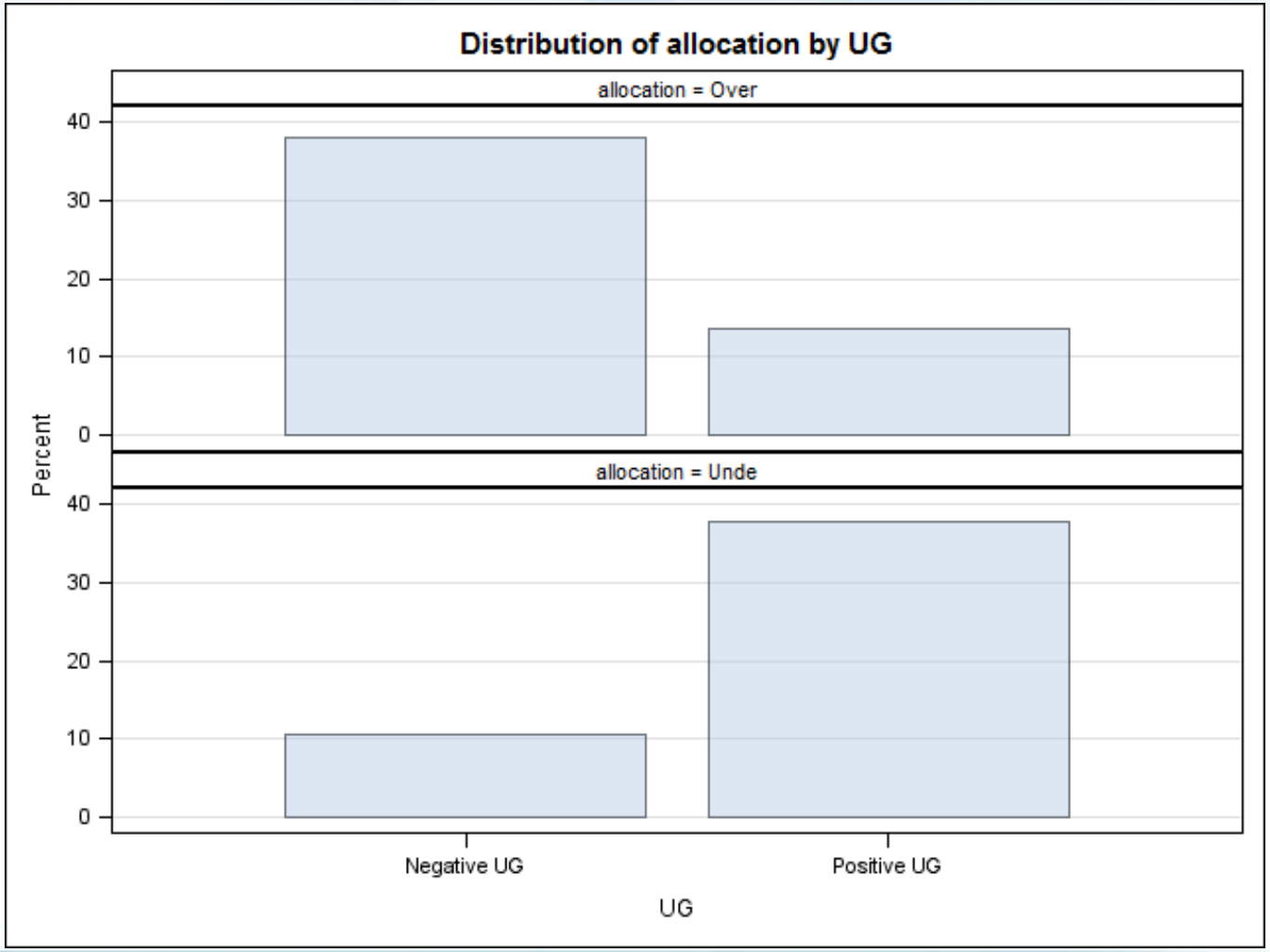
Data used in the analysis

- Simulated UG levels for 3 gas years:
  - 2012/13
  - 2013/14
  - 2014/15
- Allocation accuracy (actual vs. allocated) for 01B NDM sample data
- Daily data at LDZ level
- Removed any potential erroneous data points from the data set
  - Summer: removed any days that had a percentage UG <= -18 or >= 14
  - Winter: removed any days that had a percentage UG <= -10 or >= 13

Analysis

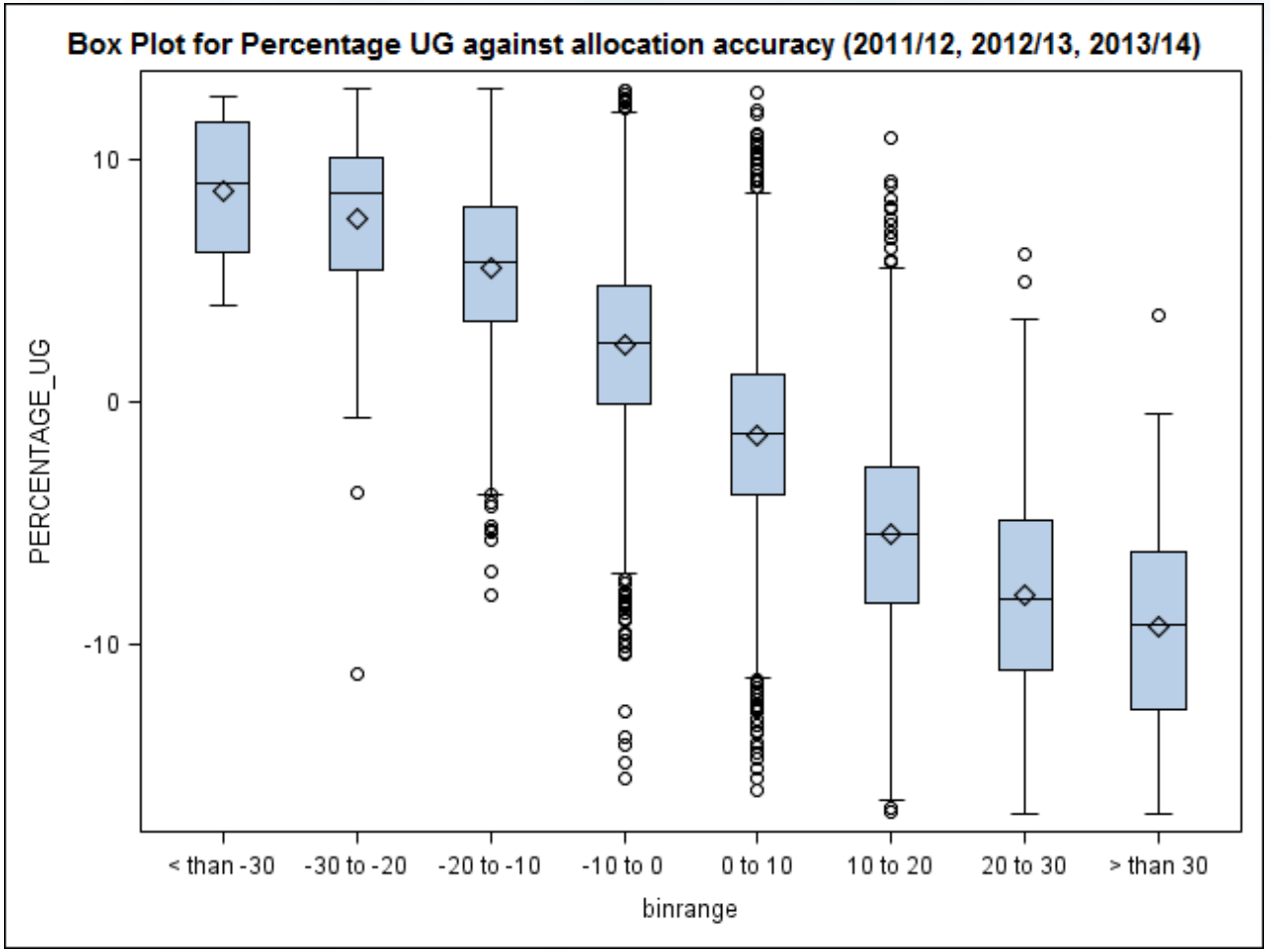
- Converted the continuous data into categorical variables (defined by the quantitative scale):
  - If actual 01B NDM sample data was below/above what was allocated then it would be given a value of “under” or “over”
  - If UG is <0 then it would be given a value of “negative” and if UG >0 it would be given a value of “positive”
- Used the Pearson Chi-square test to determine whether there is an association between 01B NDM sample data being “under” or “over” and UG being “positive” or “negative”
- Used the Cramer’s V statistic to measure the strength of the association

Allocation accuracy vs. UG levels for all 3 gas years 01B



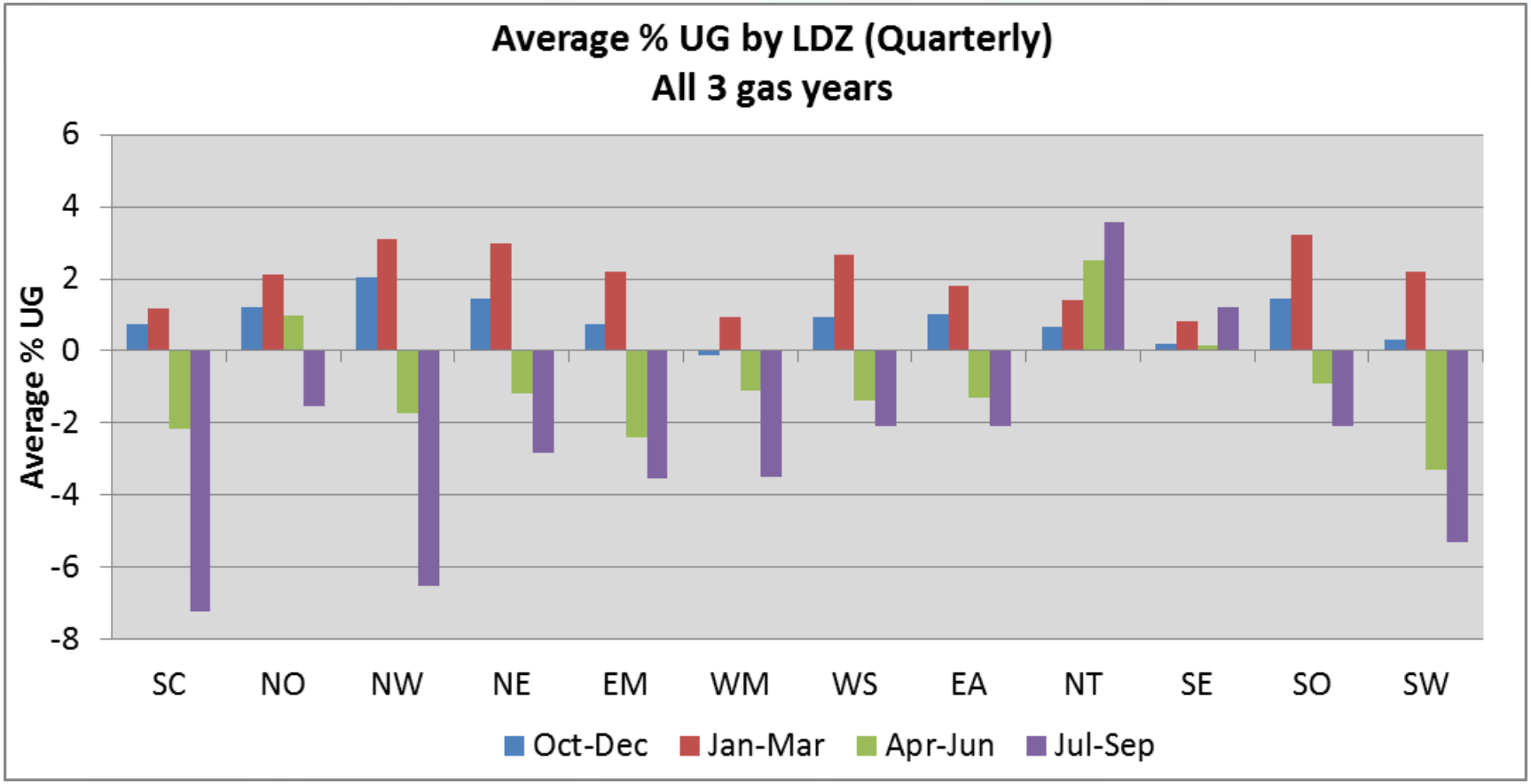
- Results from the hypothesis testing indicate that there is an association between allocation accuracy and whether UG is positive/negative
- Similar results obtained when testing over individual gas years and by seasons

Distribution of UG vs. allocation accuracy 01B



- The boxplots above show that when allocation accuracy is fairly accurate the average UG is also relatively small
- The chart also confirms that when allocation is 'over' – more likely to get a negative UG, when allocation is 'under' – more likely to get a positive UG

Average percentage UG by LDZ/Quarterly



- UG percentages are mostly larger in July to Sep. This is also when allocation inaccuracy is most frequent. Similar results obtained when displaying results by individual gas years.

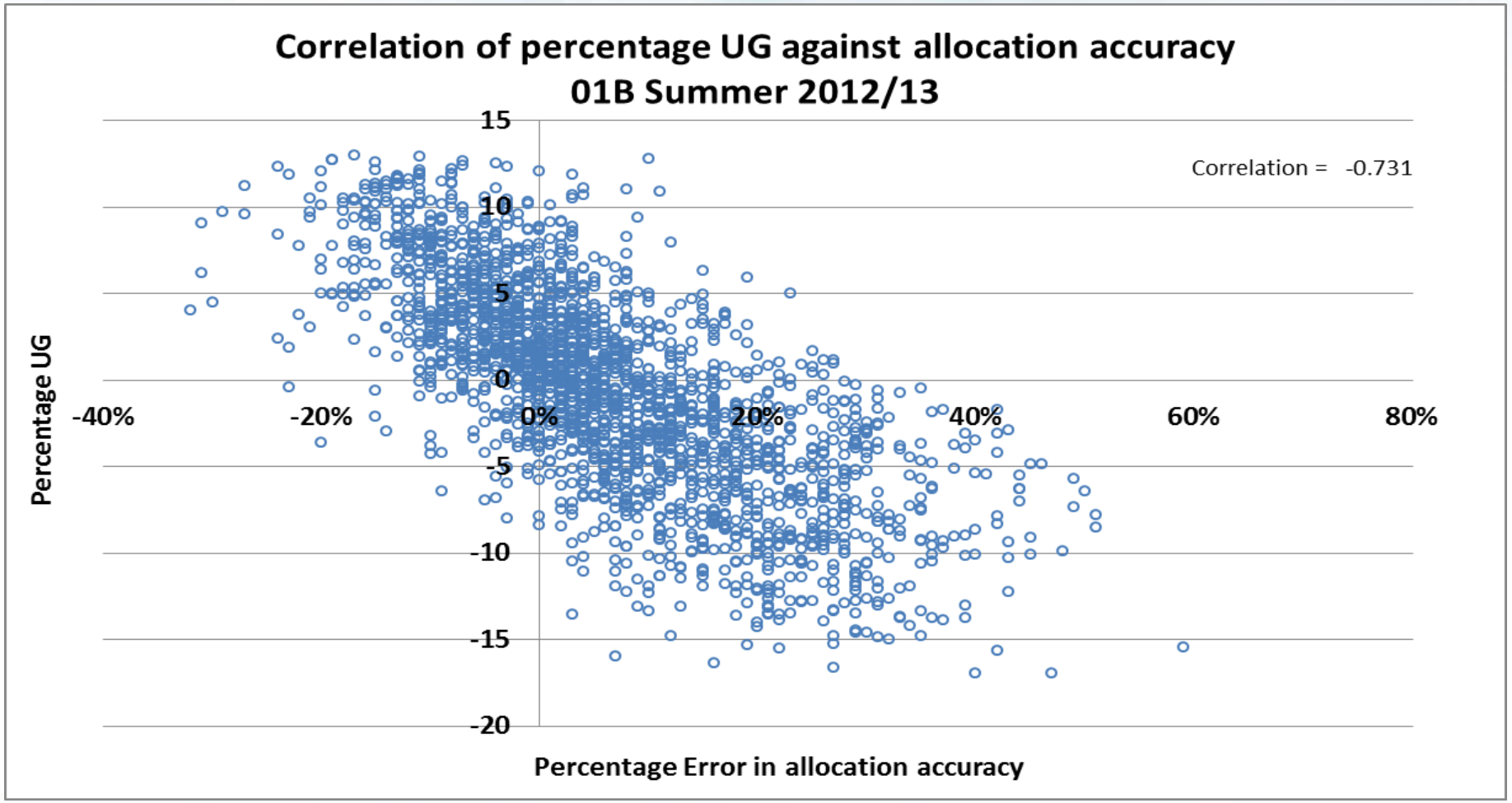
Regression Analysis

- As an association between UG and allocation accuracy exists, regression analysis and scatter plots were used to test the strength and direction of the relationship

EUC Band	Gas Year	Season	*y*	*x*	R^2
01B	2012/13	Summer	UG	Allocation accuracy	54%
01B	2012/13	Winter	UG	Allocation accuracy	50%
01B	2013/14	Summer	UG	Allocation accuracy	53%
01B	2013/14	Winter	UG	Allocation accuracy	60%
01B	2014/15	Summer	UG	Allocation accuracy	55%
01B	2014/15	Winter	UG	Allocation accuracy	52%

- The results from the regression analysis and scatter plots suggest there is a negative linear relationship between the percentage UG and the accuracy of allocation. The R^2 values suggest that allocation accuracy account for 50-60% of the variation in UG with the remaining 40% still unexplained

Scatter Plot



- The above scatter plot shows the correlation between the percentage UG and the allocation accuracy for Summer Gas Year 2012/13
- All other gas years and seasons gave similar results

Conclusions

- There is an association between allocation accuracy being under/over and unidentified gas being positive/negative
- Previous analysis on unidentified gas has been unable to establish any individual variables explaining a large proportion of the variation in UG
- The results from the regression analysis confirms 50-60% of the variation in UG is explained by the accuracy in allocation. 40% still remains unexplained
- UG percentages appear to be larger in the summer months, particularly Jul-Sep, which coincides with when allocation accuracy performs at its worst

Results for current modelling profiles

1.4) Feedback from DESC / TWG

Results of Analysis

- *1.4) Seeking feedback from DESC/TWG for any additional information / evidence they have that could assist with investigations*

  - Xoserve wrote to DESC and TWG on 29th September inviting comments on this adhoc work plan item

  - One response has been received (from E.On DESC member), response paraphrased below:

    - Happy with definition of summer period (i.e. Apr to Sep)
    - Models do not seem to reflect continued demand reduction during peak summer (where CWV is capped)
    - Increased variability where temperatures are further away from seasonal normal (this differs by season) – hard to reflect in parameters that are CWV rather than date specific
    - Shoulder periods are also variable in their behaviour but this may be more tricky to reflect in the modelling

Possible changes in existing modelling system

2.1) Confirm all parameters available within existing modelling system

Modelling System

- *2.1) Confirming all parameters available within existing modelling system influencing summer profiles e.g. summer reductions, cut offs, holidays*

  - The Spring Approach document provides detail of the various criteria and tests used (also described in Figure 3.7 of Section 3 of the NDM Algorithms booklet), some of the key ones have been picked out:

    - *"Exclude warm weather data and summer data (i.e. June to September) and fit a line to the remaining data. Any flat models are detected and re-run with all the data"*

    - *"Warm weather data (for exclusion) is defined in this context as the warmest **2º** of data (i.e. that for which the CWV is greater than Max. CWV- 2º)"*

    - *"Assess the excluded summer data against the line fitted in step (a) to establish whether a summer reduction is required. The current condition of a **5%** bar before any summer reduction is considered to apply to each individual year model will be retained".*

Modelling System cont.

- *"Reintroduce the summer data into the data set (after inflating by any summer reduction identified in step c; if no summer reduction is identified then there would be no inflation)"*

- *"The models for all EUCs will allow the possibility of summer cut-offs and summer reductions being applied. Note however that cut-offs **will not** be applied to the models derived for consumption bands up to 293 MWh pa (i.e. the "01B" and "02B" EUCs)"*

- *".....holidays **will not** be excluded from the regression models for "01B" EUCs".*

- *"Decide whether to apply summer reductions to the final smoothed model. The criterion applied in making this decision is as follows. The summer multipliers for the three individual year models for the EUC are averaged. If this average summer multiplier is less than the critical value of **0.9** (a 10% reduction), summer reductions are applied in the smoothed model; the summer multiplier for the smoothed model is this average value. If the average summer multiplier is greater than or equal to the critical value, summer reductions are not applied to the smoothed model."*

Conclusions

- As explained the existing modelling system does have parameters which can be tested with different approaches in order to try and improve the model performance in the summer period (and winter)
- Although there are a few options available it may be difficult to find an approach which is within scope of the analysis which could make a significant difference to the results
- Any thoughts from DESC on which parameters to investigate ?
- It may be necessary to explore more radical changes to the modelling approach to improve on existing performance, however this is perhaps a longer term ambition ?

Summary

Overall Conclusions and Next Steps

Overall Conclusions

- Performance reviewed over the past 3 gas years has shown that the models for 01B are generally over allocating in the summer and under allocating in the winter
- A number of the reasons for the approach to modelling for 01B were last reviewed a long time ago
- As there is an association between UG being positive/negative and allocation accuracy it would be beneficial to target improving the modelling performance, particularly in July-September which is when allocation accuracy has the largest percentage error
- One DESC representative has provided some insight to how the models work for them

Next Steps

- Create new profiles using different parameters and test them by replicating the NDM algorithm and comparing to the sample data over a number of years
- Explore other EUC Bands and see if there is an association with their allocation accuracy and UG being positive/negative
- Aim to conclude analysis by February's DESC meeting
- It is likely that in order to approve the Spring Approach to modelling 2017 at the same meeting we may need to correspond over email in between to gain opinion and advice on how the analysis is going
- Any questions ?

Appendix

Appendix

01B: LDZ results for Summer for all Gas Years

%	OverAllocation
%	Under Allocation

SUMMER: 01B: Actual versus Estimate - Error as a % of Demand

SUMMER

			SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
2014/15	Apr 15 - Sep 15	Apr	7.85	7.30	7.66	11.13	9.46	9.11	13.93	1.01	4.62	3.76	4.37	9.62	7.29
		May	-1.68	-0.59	-4.39	-0.62	-0.74	-2.30	0.91	0.04	5.94	3.26	-5.28	2.65	-0.47
		Jun	-0.17	1.86	2.34	2.35	-0.49	1.68	17.91	-3.38	-0.42	3.14	-2.05	6.55	2.01
		Jul	8.35	7.32	16.31	10.99	9.81	2.15	13.80	-5.05	-1.62	4.52	-1.62	6.82	5.74
		Aug	9.11	4.76	9.19	9.02	6.57	-1.11	5.97	4.55	5.13	-0.73	-7.07	0.84	3.89
		Sep	8.83	3.47	21.50	3.64	-3.99	10.02	13.04	3.47	-4.97	-6.64	-1.70	4.22	4.03

			SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
2013/14	Apr 14 - Sep 14	Apr	-2.70	-4.37	1.11	1.17	2.31	0.32	-2.17	3.79	6.43	6.54	-1.05	2.68	0.96
		May	0.06	-2.82	-1.00	0.30	-3.63	-5.69	-4.10	0.43	1.20	0.55	-2.38	1.90	-1.27
		Jun	12.61	5.09	12.35	-0.92	1.23	2.65	13.43	3.55	2.09	4.04	-6.41	1.42	3.95
		Jul	21.68	7.41	19.10	19.41	16.21	2.32	15.30	-1.02	-5.10	0.45	2.03	-0.61	7.59
		Aug	7.13	16.55	19.27	7.37	6.98	8.53	11.45	4.20	-7.40	8.08	0.63	9.19	7.22
		Sep	14.70	-2.53	18.85	-0.37	-2.31	12.48	15.98	-0.66	-5.28	-0.11	-2.55	3.32	3.90

			SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
2012/13	Apr 13 - Sep 13	Apr	-1.32	-0.45	-4.09	0.60	-0.83	-3.52	-7.39	2.16	-0.71	-1.71	-3.34	-5.54	-2.19
		May	-0.07	-0.24	0.23	4.92	-0.38	0.75	2.37	1.51	2.71	4.72	-0.83	5.43	1.71
		Jun	13.94	9.23	13.47	13.01	7.51	6.74	13.91	-3.69	-2.86	-1.94	-1.42	6.75	5.92
		Jul	12.09	10.79	15.81	24.12	18.69	1.99	11.04	-0.25	0.94	-1.08	6.25	16.29	9.48
		Aug	17.35	20.22	24.87	31.92	15.04	8.76	15.58	2.22	-14.56	-0.94	0.90	7.97	10.08
		Sep	3.52	5.96	10.72	-1.35	0.01	12.05	1.82	1.51	-6.21	1.02	-1.99	4.90	2.47

- Majority of LDZ / Month combinations across the 3 gas years show an over allocation in the summer

01B: LDZ results for Winter for all Gas Years

%	OverAllocation
%	Under Allocation

WINTER: 01B: Actual versus Estimate - Error as a % of Demand

WINTER

			SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
2014/15	Oct 14 - Mar 15	Oct	-0.27	-0.67	-1.90	-2.68	-4.08	-4.21	-6.72	-2.22	-1.08	5.67	-1.71	1.25	-1.73
		Nov	0.74	0.94	-0.10	2.17	0.50	2.76	-0.58	0.87	2.04	1.64	2.35	2.40	1.31
		Dec	-2.66	-0.57	-3.08	-2.44	-0.21	-1.52	-3.12	-1.65	-1.18	-2.73	1.04	-3.58	-1.76
		Jan	-2.75	-2.38	-3.75	-5.11	-0.16	-0.32	-3.74	-0.07	-0.89	-0.15	-0.03	-2.37	-1.77
		Feb	-1.20	-0.92	-1.29	-1.24	-1.18	-0.01	-3.74	1.22	-2.14	-2.29	-0.33	-2.30	-1.24
		Mar	-2.23	-3.81	-3.28	-3.27	-3.77	-3.57	-3.27	0.39	0.12	-0.15	0.43	-2.34	-2.03

			SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
2013/14	Oct 13 - Mar 14	Oct	-7.38	-5.56	-4.22	-2.98	-5.11	-5.06	-2.12	-6.83	-5.29	-5.22	-4.94	-0.73	-4.75
		Nov	-2.92	1.93	-2.39	-3.26	-2.63	0.24	-1.69	-2.61	-3.53	-4.52	1.76	-0.57	-1.73
		Dec	-4.46	-7.05	-5.04	-2.79	-3.63	-3.01	-4.63	-3.34	-3.15	-3.84	-2.33	-2.58	-3.76
		Jan	-1.10	-1.13	-5.35	-2.21	-3.53	-1.71	-6.98	-2.85	-3.05	-2.62	-3.62	-4.57	-3.23
		Feb	-2.07	-2.19	-7.36	-4.87	-4.70	-3.57	-7.83	-0.52	-0.61	-2.99	-3.72	-4.93	-3.77
		Mar	1.13	-1.10	-2.41	-0.32	0.98	-2.01	-1.01	1.29	3.79	1.93	-2.69	1.25	0.03

			SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
2012/13	Oct 12 - Mar 13	Oct	-3.41	-1.42	-5.26	-4.92	-1.90	3.01	-4.38	0.91	1.08	2.98	-2.24	-1.67	-1.63
		Nov	-4.19	-1.39	-2.89	-3.55	-1.91	1.96	-1.73	1.49	2.40	1.22	0.76	-0.42	-0.75
		Dec	-3.28	-0.40	-1.10	-4.16	-2.19	1.45	-0.11	-1.24	0.74	0.29	1.01	-0.15	-0.84
		Jan	1.25	2.13	0.36	-0.78	-0.25	2.50	0.21	1.62	3.48	2.66	2.40	4.61	1.64
		Feb	1.40	0.84	-0.28	-1.67	-1.21	0.87	0.13	1.00	3.30	0.08	0.39	2.08	0.56
		Mar	-2.17	-3.82	-3.60	-1.97	-2.18	-2.40	-2.74	-2.98	-1.16	-3.13	-5.42	-3.05	-2.87

- Majority of LDZ / Month combinations across the 3 gas years show an under allocation in the winter

01B: LDZ results by Month for all Gas Years

%	OverAllocation
%	Under Allocation

SUMMER: 01B: Actual versus Estimate - Error as a % of Demand

SUMMER MONTHS

	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
April	2014	7.85	7.30	7.66	11.13	9.46	9.11	13.93	1.01	4.62	3.76	4.37	9.62	7.29
	2013	-2.70	-4.37	1.11	1.17	2.31	0.32	-2.17	3.79	6.43	6.54	-1.05	2.68	0.96
	2012	-1.32	-0.45	-4.09	0.60	-0.83	-3.52	-7.39	2.16	-0.71	-1.71	-3.34	-5.54	-2.19
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
May	2014	-1.68	-0.59	-4.39	-0.62	-0.74	-2.30	0.91	0.04	5.94	3.26	-5.28	2.65	-0.47
	2013	0.06	-2.82	-1.00	0.30	-3.63	-5.69	-4.10	0.43	1.20	0.55	-2.38	1.90	-1.27
	2012	-0.07	-0.24	0.23	4.92	-0.38	0.75	2.37	1.51	2.71	4.72	-0.83	5.43	1.71
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
June	2014	-0.17	1.86	2.34	2.35	-0.49	1.68	17.91	-3.38	-0.42	3.14	-2.05	6.55	2.01
	2013	12.61	5.09	12.35	-0.92	1.23	2.65	13.43	3.55	2.09	4.04	-6.41	1.42	3.95
	2012	13.94	9.23	13.47	13.01	7.51	6.74	13.91	-3.69	-2.86	-1.94	-1.42	6.75	5.92
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
July	2014	8.35	7.32	16.31	10.99	9.81	2.15	13.80	-5.05	-1.62	4.52	-1.62	6.82	5.74
	2013	21.68	7.41	19.10	19.41	16.21	2.32	15.30	-1.02	-5.10	0.45	2.03	-0.61	7.59
	2012	12.09	10.79	15.81	24.12	18.69	1.99	11.04	-0.25	0.94	-1.08	6.25	16.29	9.48
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
August	2014	9.11	4.76	9.19	9.02	6.57	-1.11	5.97	4.55	5.13	-0.73	-7.07	0.84	3.89
	2013	7.13	16.55	19.27	7.37	6.98	8.53	11.45	4.20	-7.40	8.08	0.63	9.19	7.22
	2012	17.35	20.22	24.87	31.92	15.04	8.76	15.58	2.22	-14.56	-0.94	0.90	7.97	10.08
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
September	2014	8.83	3.47	21.50	3.64	-3.99	10.02	13.04	3.47	-4.97	-6.64	-1.70	4.22	4.03
	2013	14.70	-2.53	18.85	-0.37	-2.31	12.48	15.98	-0.66	-5.28	-0.11	-2.55	3.32	3.90
	2012	3.52	5.96	10.72	-1.35	0.01	12.05	1.82	1.51	-6.21	1.02	-1.99	4.90	2.47

- Majority of LDZ / Month combinations in the summer show an over allocation

01B: LDZ results for Winter for all Gas Years

%	OverAllocation
%	Under Allocation

WINTER: 01B: Actual versus Estimate - Error as a % of Demand

WINTER MONTHS

	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
October	2014	-0.27	-0.67	-1.90	-2.68	-4.08	-4.21	-6.72	-2.22	-1.08	5.67	-1.71	1.25	-1.73
	2013	-7.38	-5.56	-4.22	-2.98	-5.11	-5.06	-2.12	-6.83	-5.29	-5.22	-4.94	-0.73	-4.75
	2012	-3.41	-1.42	-5.26	-4.92	-1.90	3.01	-4.38	0.91	1.08	2.98	-2.24	-1.67	-1.63
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
November	2014	0.74	0.94	-0.10	2.17	0.50	2.76	-0.58	0.87	2.04	1.64	2.35	2.40	1.31
	2013	-2.92	1.93	-2.39	-3.26	-2.63	0.24	-1.69	-2.61	-3.53	-4.52	1.76	-0.57	-1.73
	2012	-4.19	-1.39	-2.89	-3.55	-1.91	1.96	-1.73	1.49	2.40	1.22	0.76	-0.42	-0.75
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
December	2014	-2.66	-0.57	-3.08	-2.44	-0.21	-1.52	-3.12	-1.65	-1.18	-2.73	1.04	-3.58	-1.76
	2013	-4.46	-7.05	-5.04	-2.79	-3.63	-3.01	-4.63	-3.34	-3.15	-3.84	-2.33	-2.58	-3.76
	2012	-3.28	-0.40	-1.10	-4.16	-2.19	1.45	-0.11	-1.24	0.74	0.29	1.01	-0.15	-0.84
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
January	2014	-2.75	-2.38	-3.75	-5.11	-0.16	-0.32	-3.74	-0.07	-0.89	-0.15	-0.03	-2.37	-1.77
	2013	-1.10	-1.13	-5.35	-2.21	-3.53	-1.71	-6.98	-2.85	-3.05	-2.62	-3.62	-4.57	-3.23
	2012	1.25	2.13	0.36	-0.78	-0.25	2.50	0.21	1.62	3.48	2.66	2.40	4.61	1.64
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
February	2014	-1.20	-0.92	-1.29	-1.24	-1.18	-0.01	-3.74	1.22	-2.14	-2.29	-0.33	-2.30	-1.24
	2013	-2.07	-2.19	-7.36	-4.87	-4.70	-3.57	-7.83	-0.52	-0.61	-2.99	-3.72	-4.93	-3.77
	2012	1.40	0.84	-0.28	-1.67	-1.21	0.87	0.13	1.00	3.30	0.08	0.39	2.08	0.56
	GY	SC	NO	NW	NE	EM	WM	WS	EA	NT	SE	SO	SW	All LDZs
March	2014	-2.23	-3.81	-3.28	-3.27	-3.77	-3.57	-3.27	0.39	0.12	-0.15	0.43	-2.34	-2.03
	2013	1.13	-1.10	-2.41	-0.32	0.98	-2.01	-1.01	1.29	3.79	1.93	-2.69	1.25	0.03
	2012	-2.17	-3.82	-3.60	-1.97	-2.18	-2.40	-2.74	-2.98	-1.16	-3.13	-5.42	-3.05	-2.87

- Majority of LDZ / Month combinations in the winter show an under allocation