Demand Estimation Sub Committee

NDM Algorithm Performance (Gas Year 2016/17)

11th December 2017

Background

- The implementation of Project Nexus on 1st June 2017 introduced a revised NDM demand formula, meaning some of the previous Algorithm Performance measures became redundant

- Discussions took place at DESC meetings during the build up to Nexus implementation which concluded on the following strands:
  - Strand 1 – Weather Analysis
  - Strand 2 – Unidentified Gas Analysis
  - Strand 3 – NDM Daily Demand Analysis
  - Strand 4 – Reconciliation Analysis

Objective

- Where possible, the aim of each analysis strand is to:
  - Provide statistical measures of performance as well as visual representations
  - Develop a more flexible process for Algorithm Performance, allowing us to adapt the data summaries we analyse and how results are presented
  - Carry out ‘regional’ and ‘year on year’ comparisons

- The purpose of Algorithm Performance is to:
  - Provide confidence in the NDM Supply Meter Point Demand formula
  - Identify possible areas of improvement for future demand modelling

- Objective of today’s session is to review Strand 3
  - Analysis of Strand 4 is to follow at the February’18 DESC meeting

NDM Supply Meter Point Demand formula

The revised NDM demand formula (effective from 1st June 2017) is shown below:

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

where:

AQ = Annual Quantity

ALP_t = Annual Load Profile

DAF_t = Daily Adjustment Factor

WCF_t = Weather Correction Factor

Further detail on the above parameters can be found in the ‘NDM Demand Estimation Methodology’ document

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Strand 3 – NDM Daily Demand Analysis

Background:

- An evaluation of the NDM Supply Meter Point Demand formula by comparing actual daily demands for NDM supply meter points with estimates of their daily demands across the range of EUCs

Objective:

- Assess accuracy of the algorithms for Gas Year 2016/17
- Identify possible areas of improvement for future demand modelling

Note:

- Assessment is made on supply meter points which comprise the Demand Estimation Sample
- Due to timings, data provided from shippers has been analysed separately

Strand 3 – NDM Daily Demand Analysis: Approach

Analysis has taken the following approach:

- Daily NDM consumption data obtained for Gas Year 2016/17
- Validation applied to daily NDM consumption data in order to exclude sites with suspicious or erroneous data (e.g. too many missing records)
- Calculate the % error of consumption against two bases:
  - **MODEL**: Allocated using 2016/17 ALPs, post Nexus DAFs and WCFs; NDM sample derived AQs
  - **RETRO**: Allocated using 2017/18 ALPs and DAFs (adjusted to day/holiday pattern in 2016/17); post Nexus WCFs and NDM sample derived AQs
- Assessments conducted by EUC (bucket bands only) for all LDZs for full year, summer/winter, month and day of the week
- Supporting Document contains full examples

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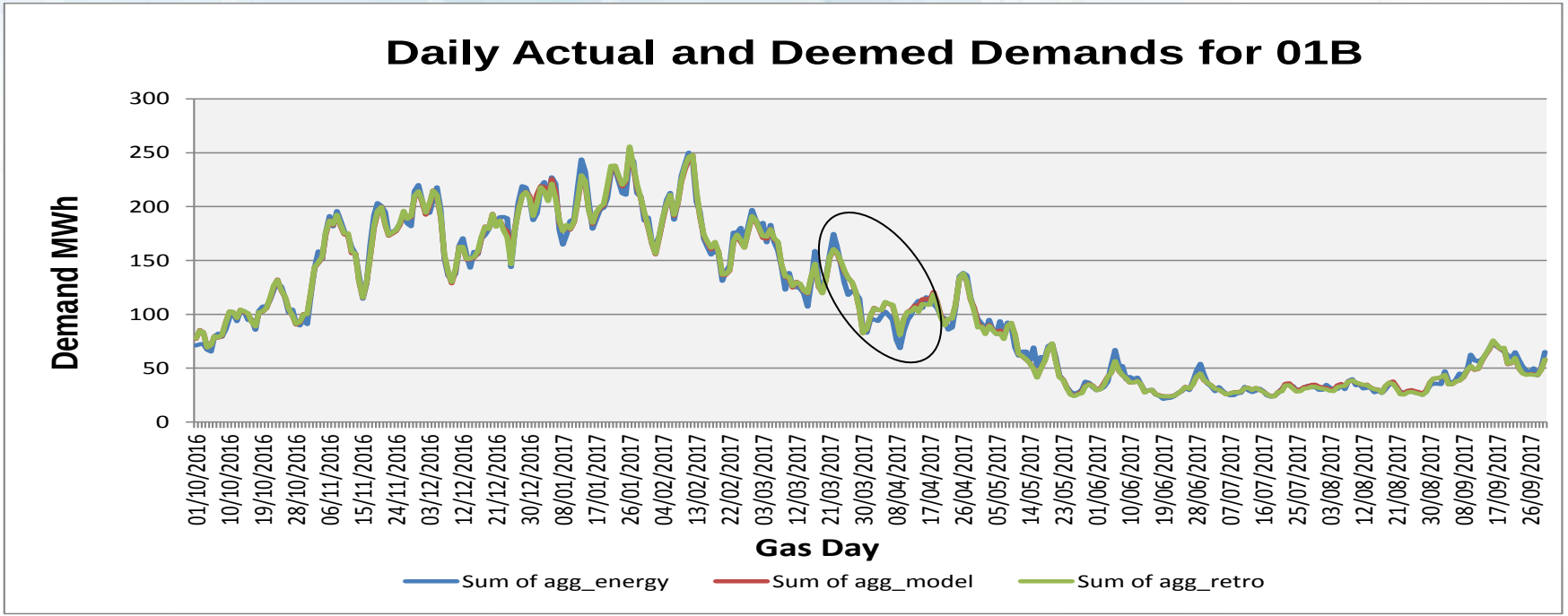
Strand 3 – NDM Daily Demand Analysis: Validated Sites

EUC	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW	Total
01b	176	199	191	189	194	198	0	182	227	184	186	209	203	2,338
02b	115	103	133	101	140	113	3	66	157	148	177	140	114	1,510
03b	171	108	111	116	141	84	13	28	134	130	176	143	110	1,465
04b	298	223	212	323	191	189	23	56	186	224	319	268	97	2,609
05b	227	112	122	141	121	132	16	31	77	131	150	110	66	1,436
06b	90	57	74	71	70	78	7	24	42	51	42	46	48	700
07b	26	29	55	43	51	33	3	14	23	19	18	16	26	356
08b	10	10	38	22	35	38	4	10	17	15	7	10	14	230
Total	1,113	841	936	1,006	943	865	69	411	863	902	1,075	942	678	10,644

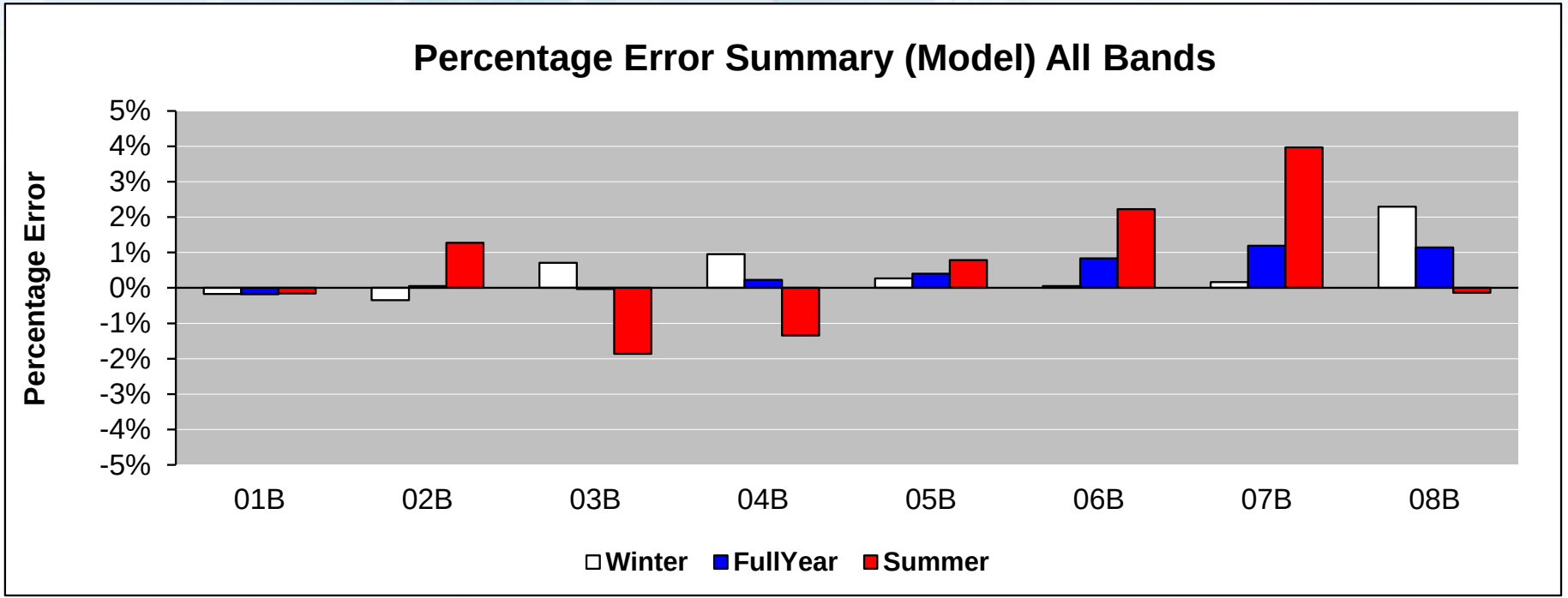
- Table shows breakdown of validated sample sites used in the analysis
- No sample data exists in Band 01 for WN LDZ, therefore no analysis has been performed
- Band 09 is only represented by a very small number of NDM supply points distributed in only some of the 13 LDZs, therefore results are disregarded in this assessment
- Some EUC & LDZ combinations contain only very few validated sample points which can skew the results significantly

Strand 3 – NDM Daily Demand Analysis: Daily Demands



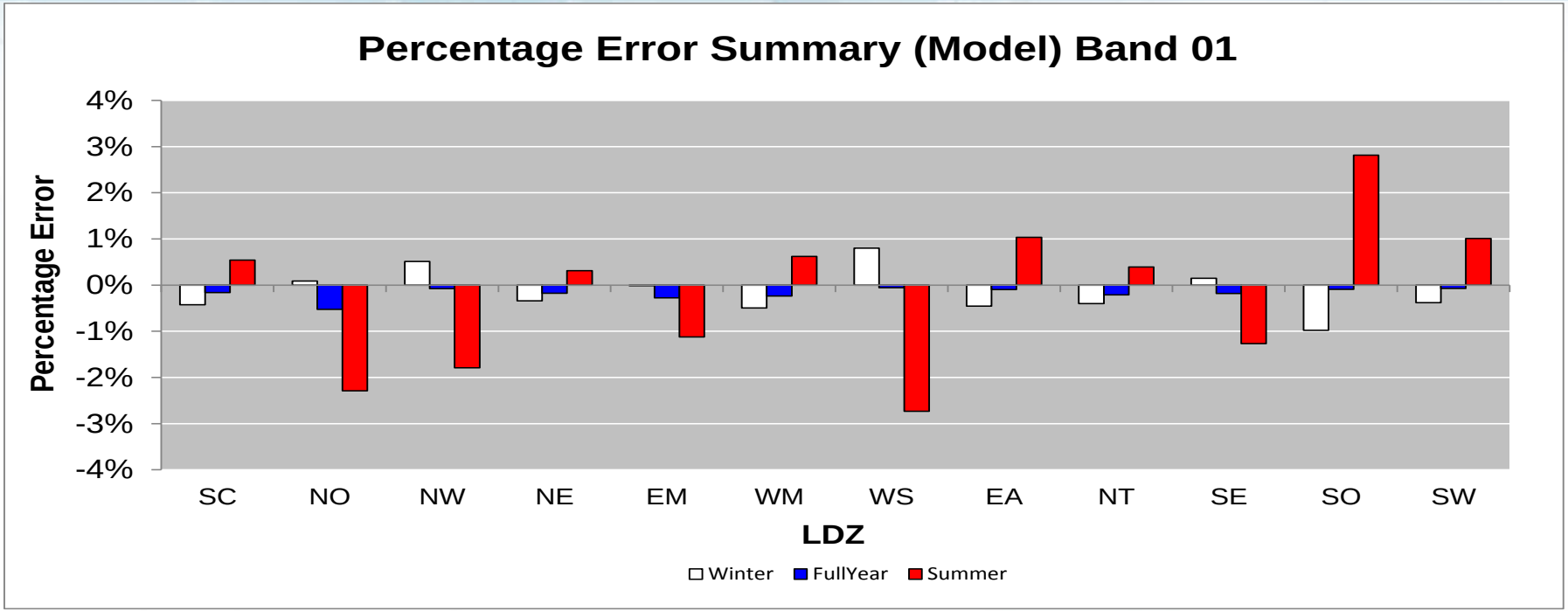
- Chart shows daily actual and allocated demand (Model & Retro basis) for Band 01b (equivalent charts for all consumption bands in supporting document)
- Shows allocated demand was generally close to actual demand
- Most notable exceptions occurred during the much warmer weather from late March to mid-April 2017

Strand 3 – NDM Daily Demand Analysis: Error Summary



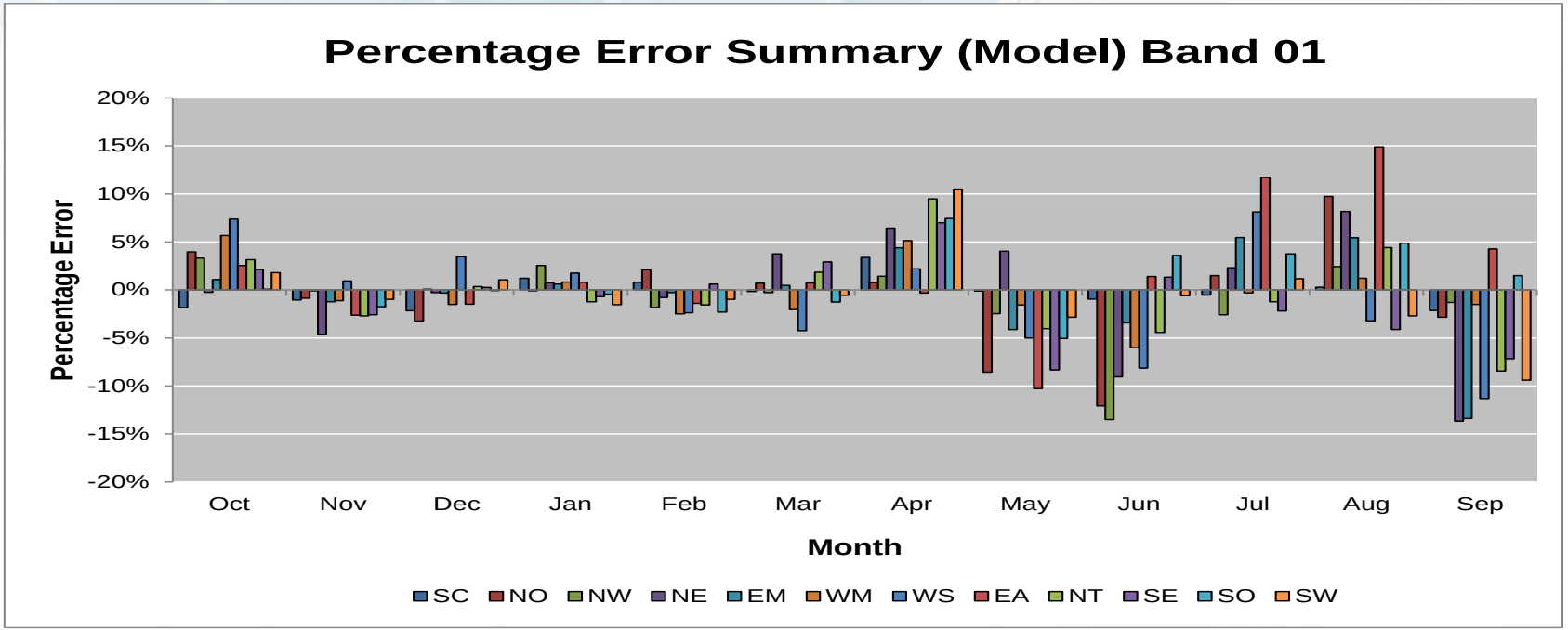
- Chart shows simple summary of the overall error on the 'Model' basis (weighted average across all LDZs)
- Full Year errors in each band were very minimal (ranging from -0.18% to +1.19%) and were marginally negative (under allocation) in bands 01 and 03 and slightly positive (over allocation) in all other bands
- Winter / Summer errors suggest band 01 under allocates in winter & summer; profiles for bands 03, 04 & 08 were little too peaky and profiles for bands 02, 05, 06 & 07 were too flat

Strand 3 – NDM Daily Demand Analysis: Error Summary



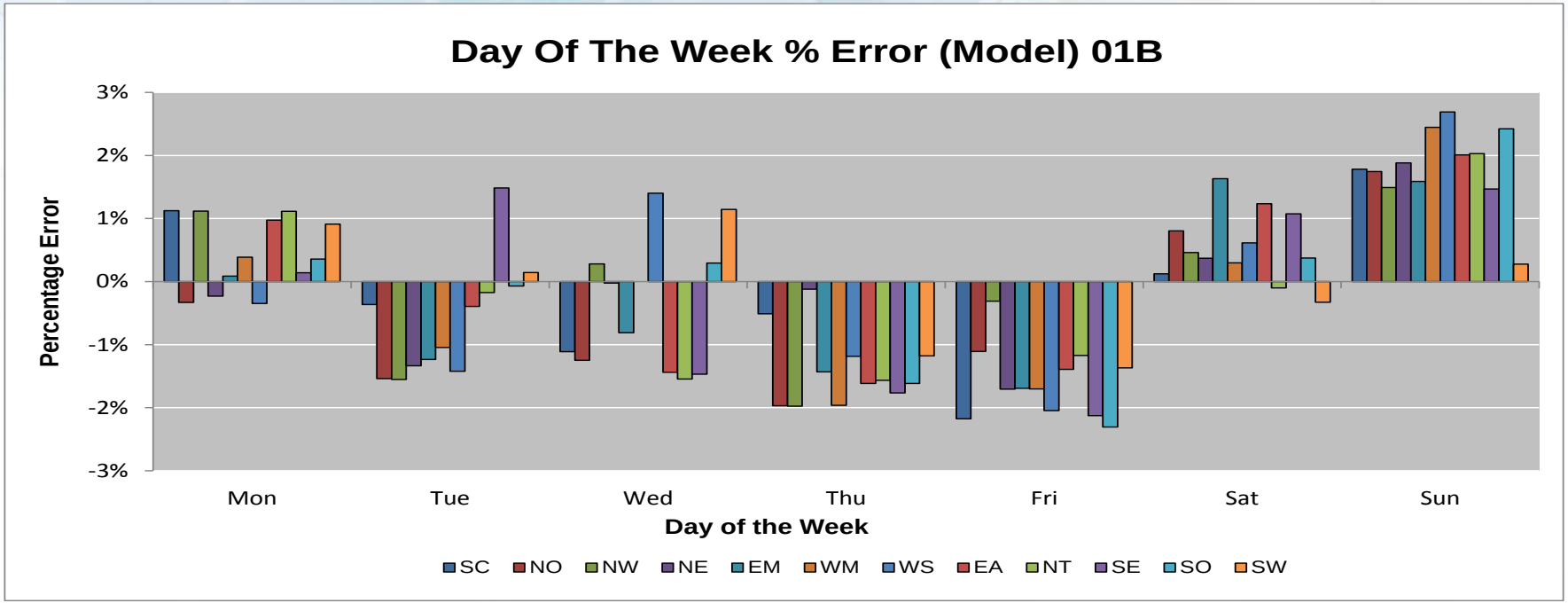
- Chart shows % error over the winter, summer and full year by LDZ, for Band 01b
- Full year percentage errors are negative in all 12 LDZs (no data for WN) and lie within a range of -0.52% to -0.05%
- Actual summer demands are lower and hence percentage errors can be somewhat greater in the summer

Strand 3 – NDM Daily Demand Analysis: Error Summary



- Chart shows % errors for each month for Band 01b on the 'Model' basis
- Indicates mostly winter under allocation in Nov'16 (13th coldest November in 50 years), Dec'16 and Feb'17 but mostly over allocation in Oct'16, Jan'17 and Mar'17
- During the summer months, mostly over allocation in Apr'17 (8th warmest April in 50 years), Jul'17 and Aug'17, whilst mostly under allocation in May'17, Jun'17 and Sep'17

Strand 3 – NDM Daily Demand Analysis: Error Summary



- Chart shows % errors over the days of the week, by LDZ, for Band 01b
- Shows mostly under allocation during weekdays (i.e. Monday to Friday) and over allocation during weekend days (i.e. Saturday and Sunday)
- Equivalent charts for remaining bands in the supporting document

Strand 3 – NDM Daily Demand Analysis: Retro Analysis

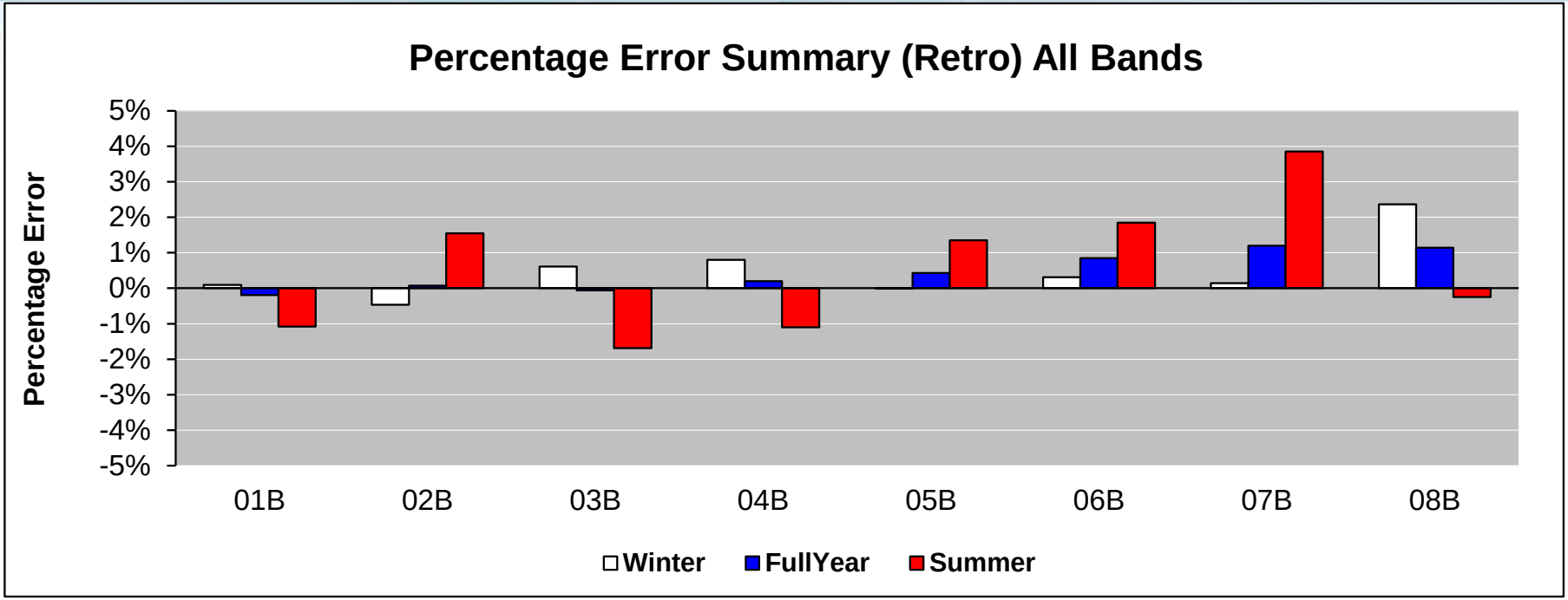
- The ‘Retro’ analysis is based on the algorithms derived for the current gas year (i.e. 2017/18) but retro fitted with appropriate adjustment for the pattern of days of the week and holidays for gas year 2016/17

- This analysis is helpful in assessing the performance of the most current algorithms had they applied to the gas year being analysed

- A notable change to the 2017/18 algorithms saw the exclusion of holidays from the regression models for 01B EUCs

- This decision was made following evidence presented at the Feb’17 DESC meeting which focused on the performance of the 01B models during the summer months

Strand 3 – NDM Daily Demand Analysis: Retro Analysis



- Chart shows the algorithms derived for Gas Year 2017/18 would (if applied to gas year 2016/17) have resulted in a similar outcome overall
- Full Year errors are very small overall for all bands and range from -0.19% to +1.20% (Model basis errors were -0.18% to +1.19%)
- Winter / Summer period errors are slightly improved (compared to Model basis) for bands 03, 04, 06 & 07 and are slightly worse for bands 01, 02, 05 & 08

Strand 3 – NDM Daily Demand Analysis: Retro Analysis

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	-0.43%	-0.16%	0.31%	-0.09%	0.14%	-0.02%	-1.16%	0.23%	-0.89%	0.09%	0.88%	-1.06%
NO	0.50%	-0.50%	0.40%	-0.08%	0.51%	0.49%	-0.44%	0.45%	-0.09%	-0.59%	-3.87%	-0.48%
NW	0.55%	0.11%	0.13%	-0.23%	-0.29%	-0.16%	-1.32%	-0.16%	-0.97%	0.36%	-1.64%	-1.00%
NE	1.51%	-0.67%	0.22%	0.68%	-0.64%	0.12%	-1.93%	-3.56%	-1.75%	-1.87%	-1.63%	-3.91%
EM	0.30%	-0.56%	0.14%	0.19%	0.05%	0.50%	-1.09%	0.04%	0.36%	-4.91%	-4.11%	0.41%
WM	0.29%	-0.33%	0.14%	-0.26%	-0.31%	-0.34%	-0.65%	0.17%	0.04%	0.45%	-1.18%	-0.27%
WS	0.46%	0.56%	-0.01%	-0.08%	-0.56%	-0.51%	-0.74%	1.06%	1.01%	-1.61%	1.63%	-0.08%
EA	0.34%	-0.50%	0.03%	-0.04%	-0.52%	0.46%	0.80%	0.41%	-0.62%	-1.81%	-2.90%	0.01%
NT	0.38%	-1.06%	0.17%	-0.64%	-1.16%	0.87%	-1.79%	2.21%	3.10%	4.37%	-4.21%	0.99%
SE	0.42%	-0.78%	0.03%	-0.29%	0.86%	0.70%	-1.71%	1.18%	-0.92%	3.09%	3.30%	0.36%
SO	0.36%	-0.42%	0.34%	0.29%	-0.44%	-0.43%	-0.14%	0.31%	-0.02%	-1.34%	-2.08%	0.27%
SW	0.38%	-0.66%	-0.50%	-0.09%	-0.69%	-0.47%	-0.90%	1.02%	1.01%	-0.58%	1.95%	0.30%

- Table shows comparison of Band 01 errors from the ‘MODEL’ and ‘RETRO’ analysis (Absolute difference)
- Green denotes an improvement; Red denotes a worsening
- Months with the most notable improvements were April 2017 (11 out of 12 LDZs improved), November 2016 (10 out of 12 LDZs improved) and January 2017 (9 out of 12 LDZs improved)
- Months that saw errors deteriorate the most were October 2016 (11 of the 12 LDZs worsened) and December 2016 and May 2017 (10 out of 12 LDZs worsened)

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Strand 3 – NDM Daily Demand Analysis: Conclusions

NDM Daily Demand Analysis suggests:

- Band 01 models (Model basis) have a tendency to under allocate in winter & summer, however analysis on Retro basis suggested the models were slightly too peaky
- Bands 03, 04 & 08 the models (on Model & Retro assessments) are slightly too peaky
- Bands 02, 05, 06 & 07 the models (on Model & Retro assessments) are slightly too flat

Full Year errors across individual LDZs are as follows:

- Band 01: -0.52% to -0.05% (Model); -0.53% to -0.03% (Retro)
- Bands 02 to 08: -0.47% to +2.77% (Model); -0.42% to +2.89% (Retro)

Impact of exclusion of holidays from the regression models for 01B EUCs

- Analysis on the Retro basis shows a mixture of some small improvements and small worsening of the percentage error across all LDZ and month combinations
- No clear improvement was noted in band 01b over the summer period, however it should be noted that the weather which prevailed was fairly mild overall

Strand 3 – NDM Daily Demand Analysis: Considerations

Caveats for consideration:

- NDM Daily Demand analysis is based on validated NDM SAMPLE data, which despite our attempts, may not be necessarily be representative of the population as a whole
- The sample suffers from small numbers of contributing supply meter points at the higher consumption bands
- Strand 3 evaluation document published on Joint Office website with full examples

DESC Members to consider:

- Is there anything that should be included in the 2018 Spring Approach? (within the current process framework)
- Is there any further Ad-hoc work which might influence a future year's modelling?

Next Steps

Next Steps:

- NDM Daily Demand Analysis for gas year 2016/17 using 3rd party data

- Strand 4 (Reconciliation Analysis) to follow at the February'18 DESC meeting

Third Party Data

- **We need your help!** - by 3rd April 2018 we require additional NDM sample data covering the period from 24/03/2017 to 01/04/2018 inclusive for use in the Spring 2018 modelling (Band 01B in particular)
- Full requirements document available on Joint Office website

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