Demand Estimation Sub Committee

NDM Algorithm Performance (Gas Year 2018/19)
Strand 3 Analysis – NDM Daily Demand Analysis

9th December 2019

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 2018/19
- Identify possible areas of improvement for future demand modelling

Note:

- Assessment is made on supply meter points which comprise the Demand Estimation Sample and data provided (voluntarily) by shippers

NOTE: MOD654s (mandating provision of daily data) went live on 1st March 2019, so data provided from 1st October 2018 has been voluntarily provided

Strand 3: Things to Consider

In the summer of 2018, in order to directly impact the overall levels and volatility of Unidentified Gas (UIG), DESC approved the application of ‘Uplift’ factors to the approved demand models for Gas Year 2018/19

Impact on Demand Models for Gas Year 2018/19:

- Uplifts applied to ALPs for EUC band 01B only (with a slightly greater uplift to Winter period)
- Uplifts applied to DAFs for all EUC bands

In 2019, DESC approved the partial application of ‘Uplifts’ to the Gas Year 2019/20 demand models

Impact on Demand Models for Gas Year 2019/20:

- Uplifts applied to DAFs for all EUC bands

See ‘NDM Demand Estimation Methodology’ document for details

Strand 3: Approach

Analysis has taken the following approach:

- Daily NDM consumption data obtained for Gas Year 2018/19

- Validation applied to all daily NDM consumption data in order to exclude sites with suspicious or erroneous data

- Calculate the % error of allocation against three bases:
  - **MODEL(inc)**: Allocated using 2018/19 ALPs, DAFs and WCFs (including 'Uplift' factors; NDM sample derived AQs
  - **MODEL(exc)**: Allocated using 2018/19 ALPs, DAFs and WCFs (excluding 'Uplift' factors; NDM sample derived AQs
  - **RETRO**: Allocated using 2019/20 ALPs, DAFs (excluding 'Uplift' factors, adjusted to day/holiday pattern in 2018/19); WCFs and NDM sample derived AQs

- Assessments conducted by EUC (bucket bands only) for all LDZs for full year, summer/winter and by month

Strand 3: Source Data - Summary

- Daily NDM consumption data for Gas Year 2018/19 was available from the following three sources:
  - Xoserve Managed; Network Managed & Third Party Provided (i.e. Shippers)
- Validation excludes Supply Meter Points which are deemed not usable
  - i.e. insufficient data points; excessive consecutive zero consumption; excessive or negative consumption; suspicious day of the week profile; obvious Market Sector Flag inaccuracies
  - sites with erroneous data may slip through and will affect the perceived results
- Table below summarises the Supply Meter Point counts

Source	Xoserve Managed	Network Managed	3rd Party Provided	Total
Initial SP Count of Available Data	2,435	9,010	19,944	31,389
Final SP Count of Usable Data	2,098	5,643	11,149	18,890
% Deemed Usable	86%	63%	56%	60%

Strand 3: Source Data - Breakdown

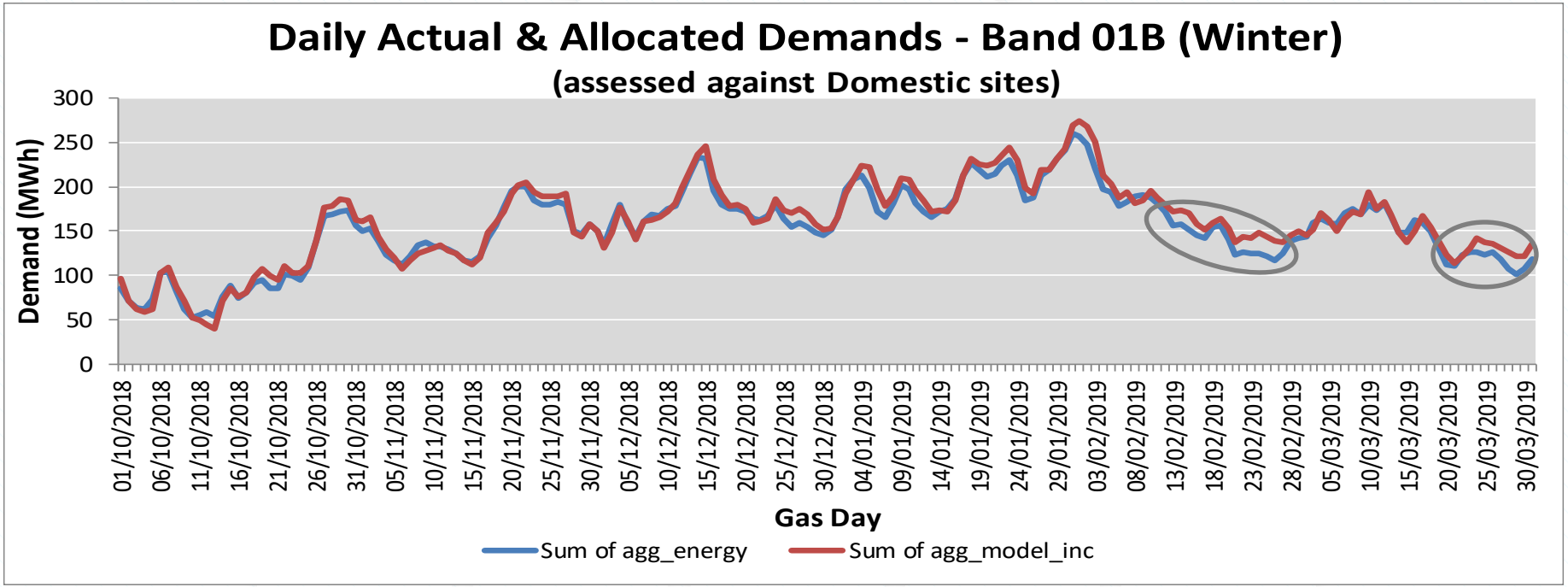
EUC	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW	ALL LDZs	% Non-Third Party	% Third Party
01B Dom	193	180	185	210	193	215	49	183	206	193	213	205	225	2,450	63%	37%
01B I&C	505	216	349	213	259	242	48	119	333	265	334	186	198	3,267	4%	96%
02B Dom	15	5	8	6	10	10	0	3	10	10	6	8	11	102	100%	0%
02B I&C	774	240	449	223	441	454	36	128	519	412	417	347	291	4,731	21%	79%
03B I&C	801	139	253	160	245	206	38	55	233	238	279	204	189	3,040	37%	63%
04B I&C	621	208	239	276	182	211	34	81	221	243	393	286	152	3,147	66%	34%
05B I&C	252	105	111	129	99	122	14	36	82	137	156	98	63	1,404	79%	21%
06B I&C	88	35	35	48	50	44	4	17	23	36	39	40	28	487	89%	11%
07B I&C	30	10	21	21	25	19	1	5	9	5	14	10	14	184	91%	9%
08B I&C	8	7	6	5	12	12	1	4	6	5	3	4	5	78	90%	10%
Total	3,287	1,145	1,656	1,291	1,516	1,535	225	631	1,642	1,544	1,854	1,388	1,176	18,890		

- Table shows breakdown of validated sample sites available for analysis
- Good numbers overall, but some EUC & LDZ combinations contain either no sample data (therefore no analysis is possible) or very few validated sample points (which can skew the results significantly)
- Analysis has not been performed for PrePayment (no data) or for Band 09B (only 10 NDM supply points)

Strand 3 – NDM Daily Demand Analysis

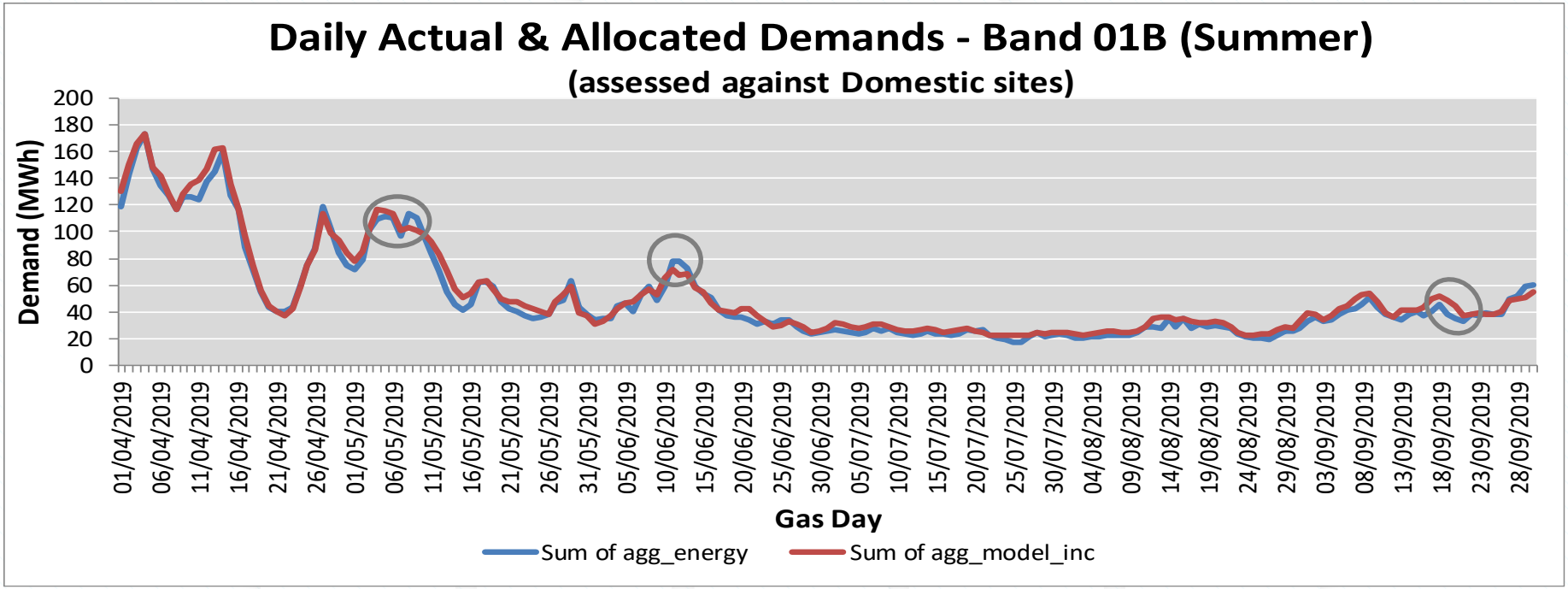
Gas Year 2018/19 Results

Strand 3: MODEL(inc) – Band 01B



- Graph shows daily actual and allocated demand on Model(inc) basis for Winter (Band 01B; Domestic sites)
- Clear tendency of over allocation throughout most of Winter period ('Uplift' factors a contributing factor)
- Most notable periods of allocation difference occurred during the much warmer than normal spells during most of February'19 and the latter half of March'19

Strand 3: MODEL(inc) – Band 01B

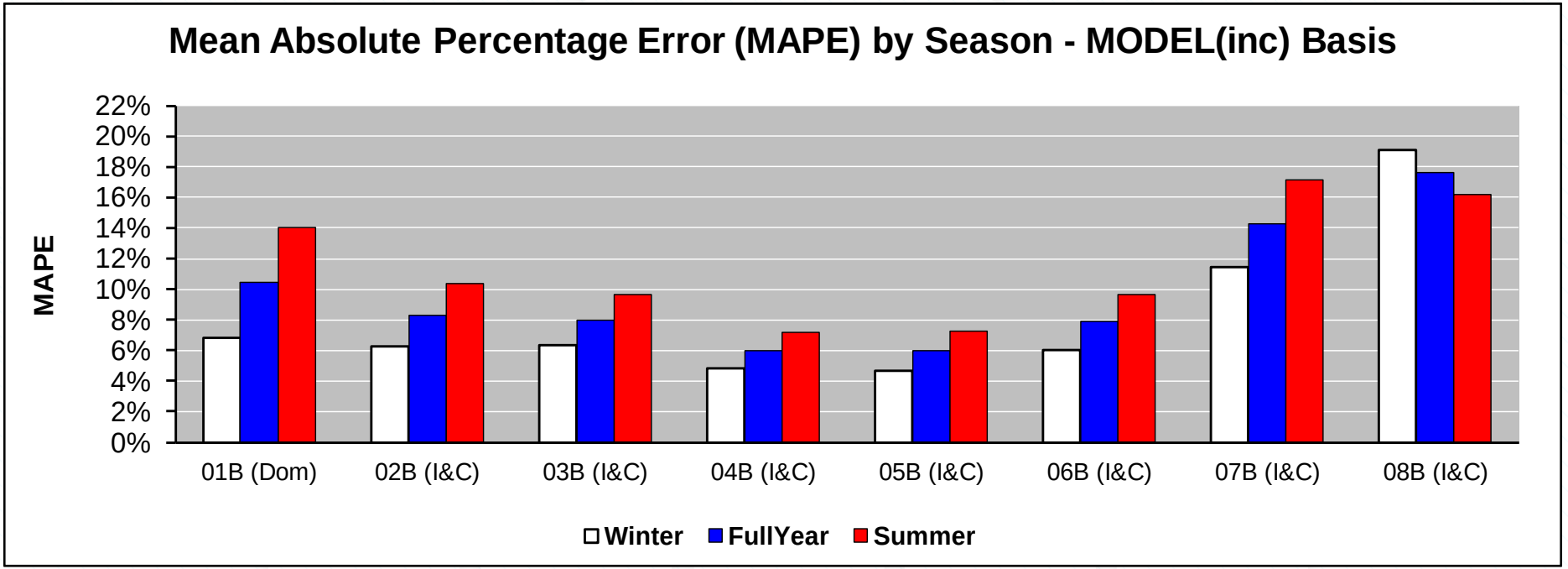


- Graph shows same assessment as previous graph but for Summer period
- Similar tendency of over allocation throughout most of Summer period
- Most notable periods of allocation difference occurred during the colder than normal spells during 4th to 11th May'19 and 10th to 15th June'19 and the much warmer than normal period in late September'19

Strand 3: MAPE Analysis

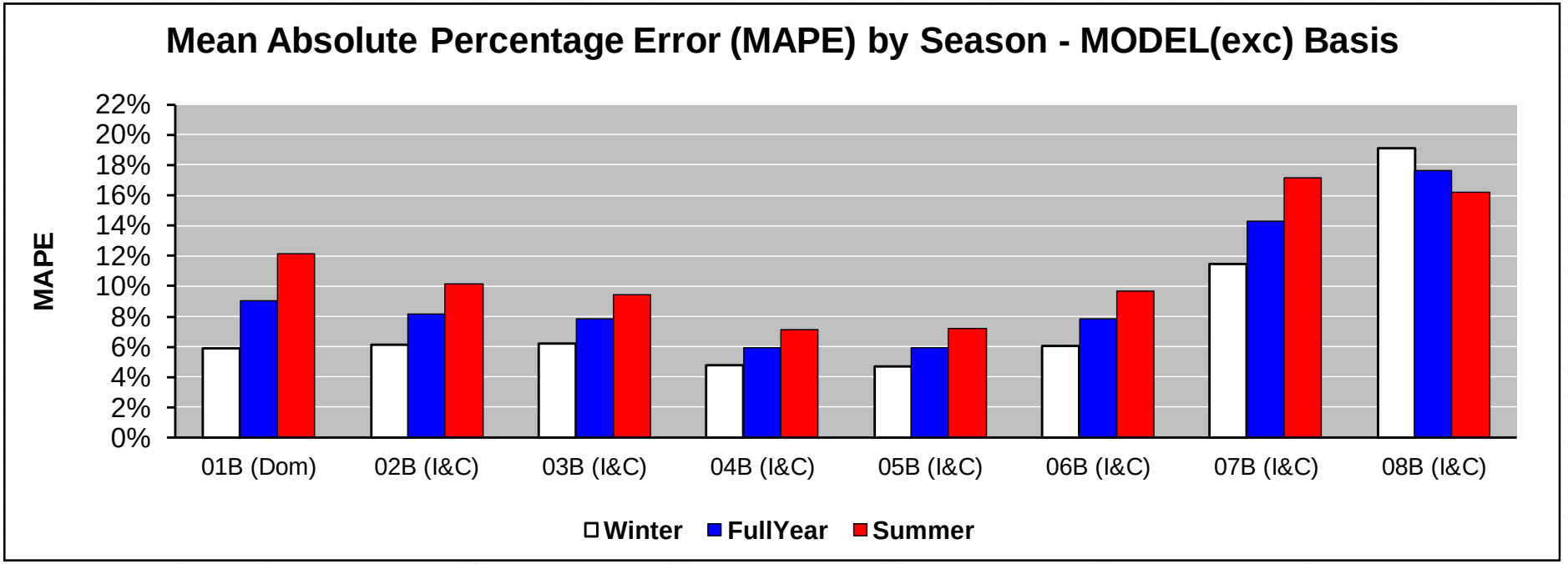
- Mean Absolute Percentage Error (MAPE) is a measure of prediction accuracy of a forecasting method
- MAPE analysis has been performed for each EUC bucket band (weighted average across all LDZs) against each of the three bases for Winter, Summer and Full Year periods
- First time using MAPE to review the error (previous years have assessed using overall % error which can hide the daily error – MAPE removes any ‘netting off’ of errors)
- The lower the MAPE value, the closer the prediction was to the actual value. For example, a MAPE of 3% means that, on average, the forecast is out by 3%.

Strand 3: MODEL(inc) – EUC Band Summary



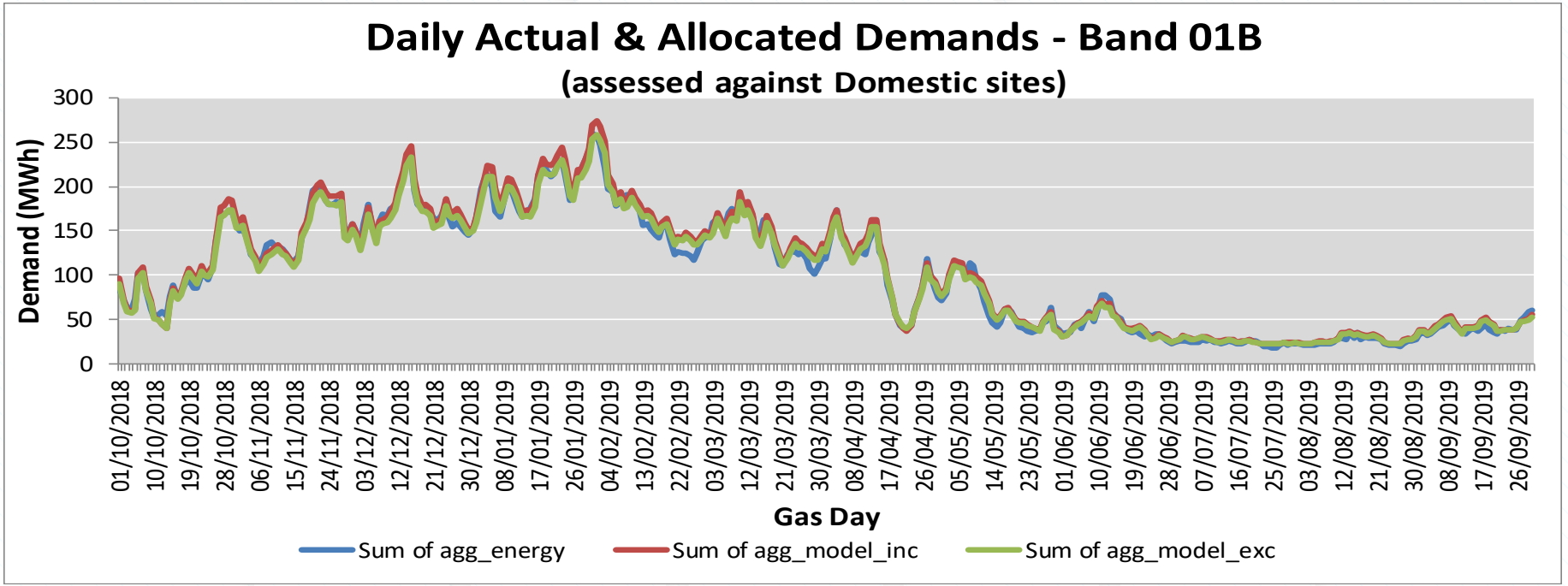
- Chart shows simple summary of the overall error on the ‘Model(inc)’ basis
- Full Year MAPE values range from 5.97% to 17.63%
- Note: Actual summer demands are lower than winter demands and hence percentage errors can be somewhat greater in the summer

Strand 3: MODEL(exc) – EUC Band Summary



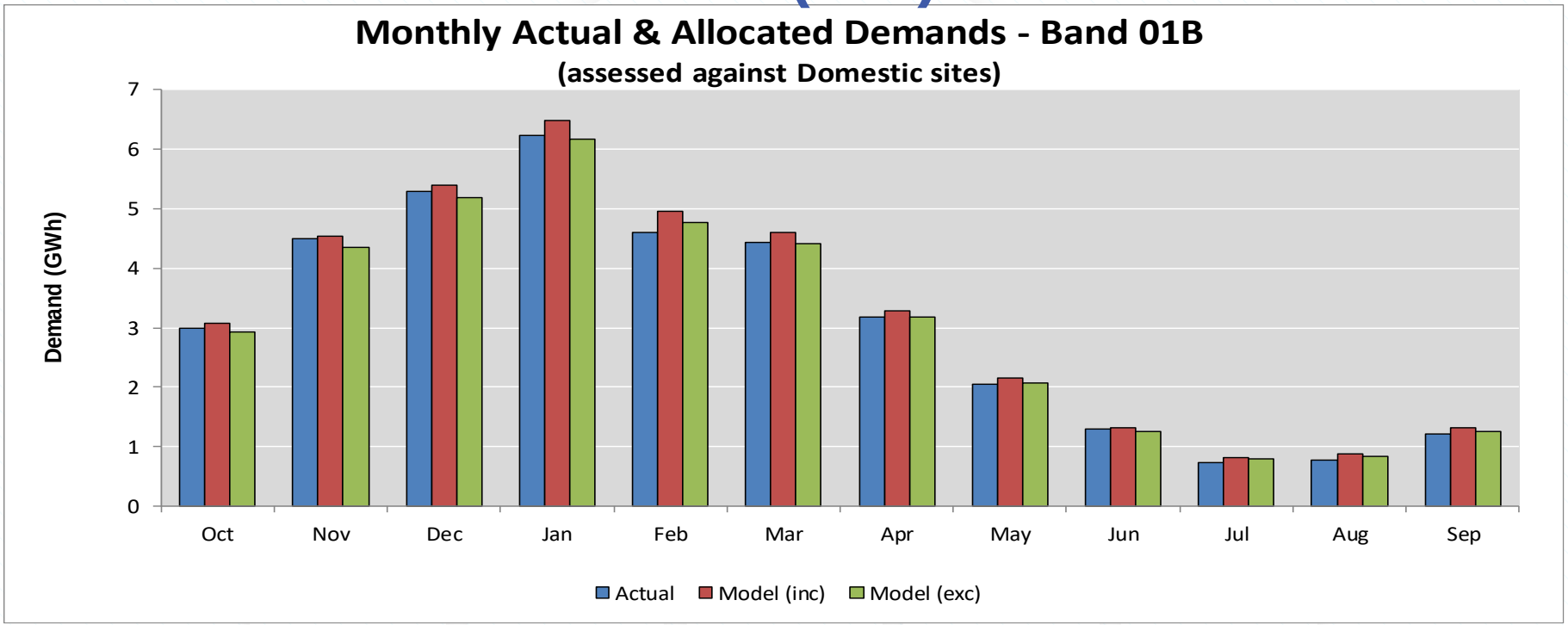
- Chart shows how the models for Gas Year 2018/19 without the uplifts (i.e. 'Model(exc)' basis) would have performed if they had been applied
- Generally, most bands show a reduction in MAPE versus 'Model(inc)' basis, showing improvement to allocation (Full Year MAPE values range from 5.93% to 17.64%)
- Band 01B shows a significant reduction, most likely due to ALP uplift which only applied to this band

Strand 3: MODEL(exc) – Band 01B



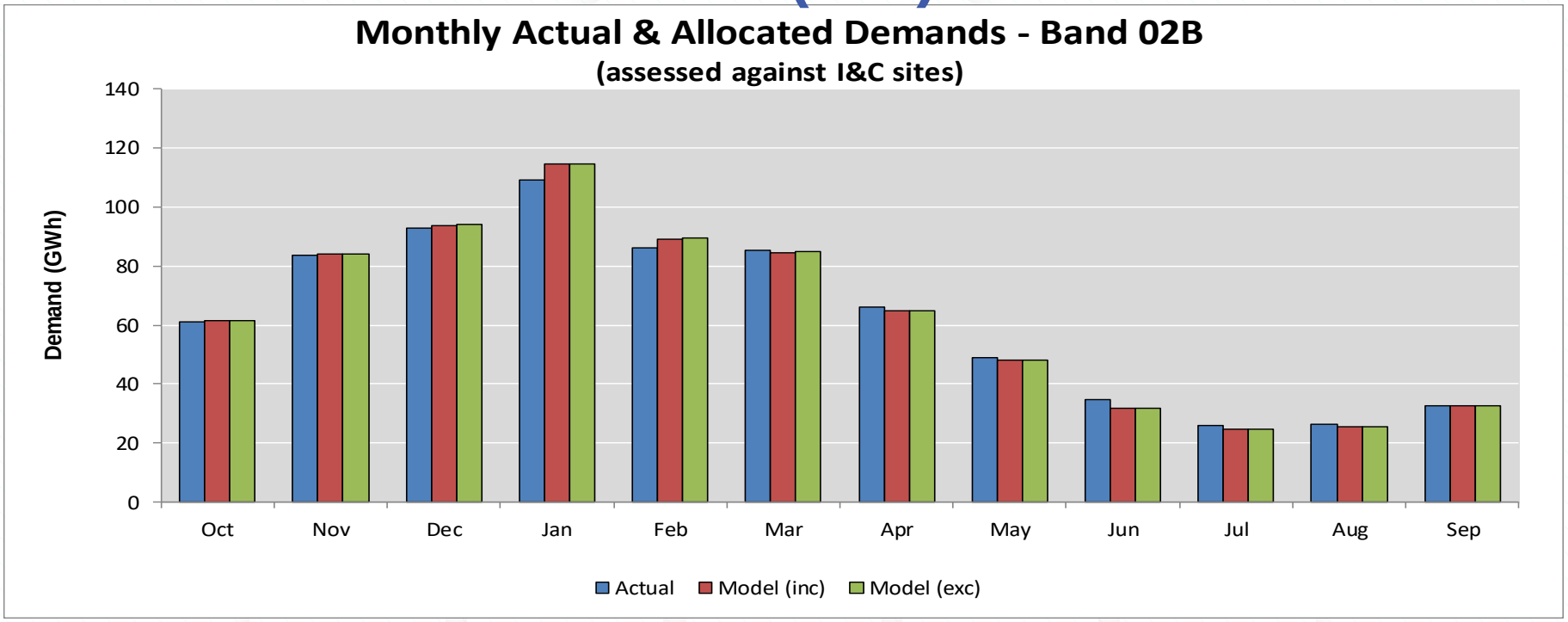
- Graph shows daily actual and allocated (both Model ‘inc’ & ‘exc’ basis) for Band 01B against Domestic sites
- Allocated demand seems to track well against actual demand for the majority of days throughout the year

Strand 3: MODEL(exc) – Band 01B



- Chart shows monthly actual and allocated demand (both Model ‘inc’ & ‘exc’) for Band 01B against Dom sites
- Considering the ‘exc’ basis, under allocation was evident in all winter months except in February (a warmer than normal month) whilst in the summer months over allocation was present for all months with the exception of June

Strand 3: MODEL(exc) – Band 02B



- Chart shows monthly actual and allocated demand (both Model ‘inc’ & ‘exc’ basis) for Band 02B against I&C sites
- Analysis of ‘exc’ basis indicates winter over allocation from October’18 to February’19 and under allocation for each of the summer months

Strand 3: MODEL(exc) – Current vs Previous Year

Profiles	2017/18 Profiles		2018/19 Profiles		
Analysis	MODEL using 2017/18 Data		MODEL(exc) using 2018/19 Data		
EUC	Sample Count	MAPE (Full Year)	Sample Count	MAPE (Full Year)	vs Previous Year
01B (Dom)	2,713	10.02%	2,450	9.03%	-1.00%
02B (I&C)	4,916	15.08%	4,731	8.15%	-6.94%
03B (I&C)	3,387	15.20%	3,040	7.81%	-7.39%
04B (I&C)	3,211	7.48%	3,147	5.93%	-1.55%
05B (I&C)	1,347	6.68%	1,404	5.93%	-0.75%
06B (I&C)	498	7.46%	487	7.87%	0.41%
07B (I&C)	168	14.95%	184	14.30%	-0.65%
08B (I&C)	75	13.21%	78	17.64%	4.43%

- Table shows comparison of Full Year MAPE by EUC against the equivalent analysis from the previous year, on the 'Model(exc)' basis
- Green denotes an improvement; Red denotes a worsening
- The majority of EUCs show an improvement in allocation over the full year

Strand 3: Retro Basis Analysis

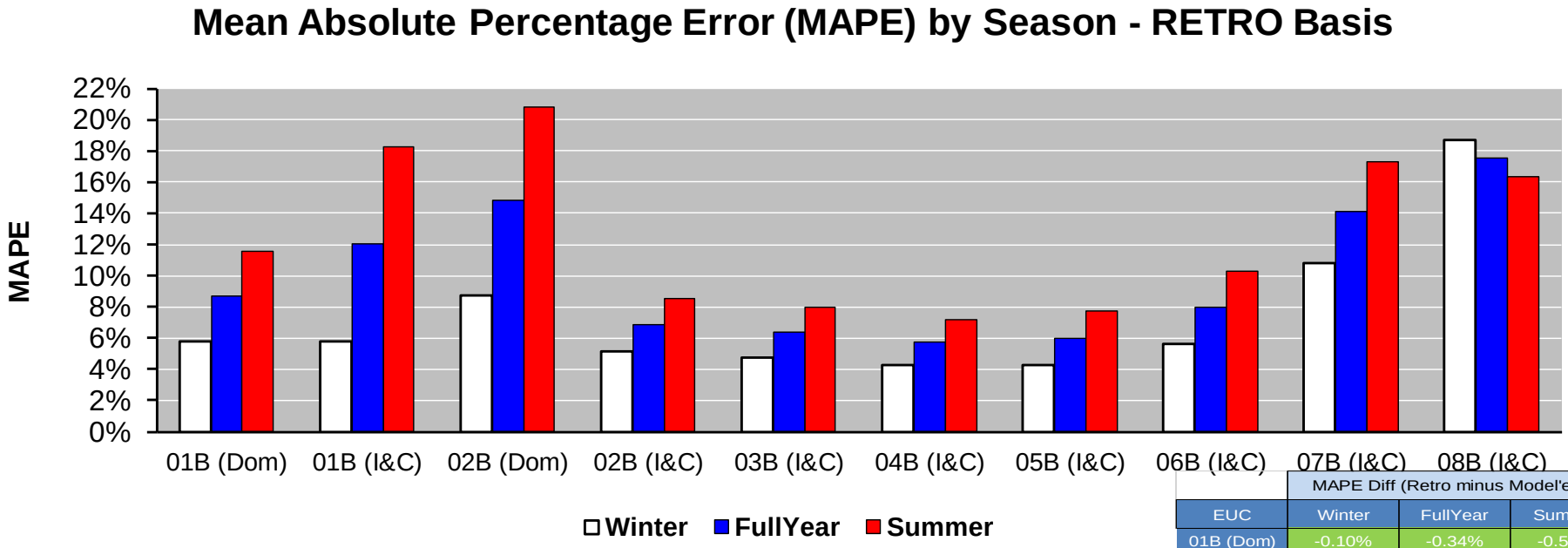
- The ‘Retro’ analysis is based on the algorithms derived for the current Gas Year (i.e. 2019/20) but retro fitted with appropriate adjustment for the pattern of days of the week and holidays for Gas Year 2018/19

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

- This assessment does not include the uplift factors applied to the DAFs for Gas Year 2019/20 (as it would not provide a test on the raw derived factors)

- Analysis of the dedicated profiles for I&C sites in Band 01B and Domestic sites in Band 02B, which became effective for gas year 2019/20, has also been completed

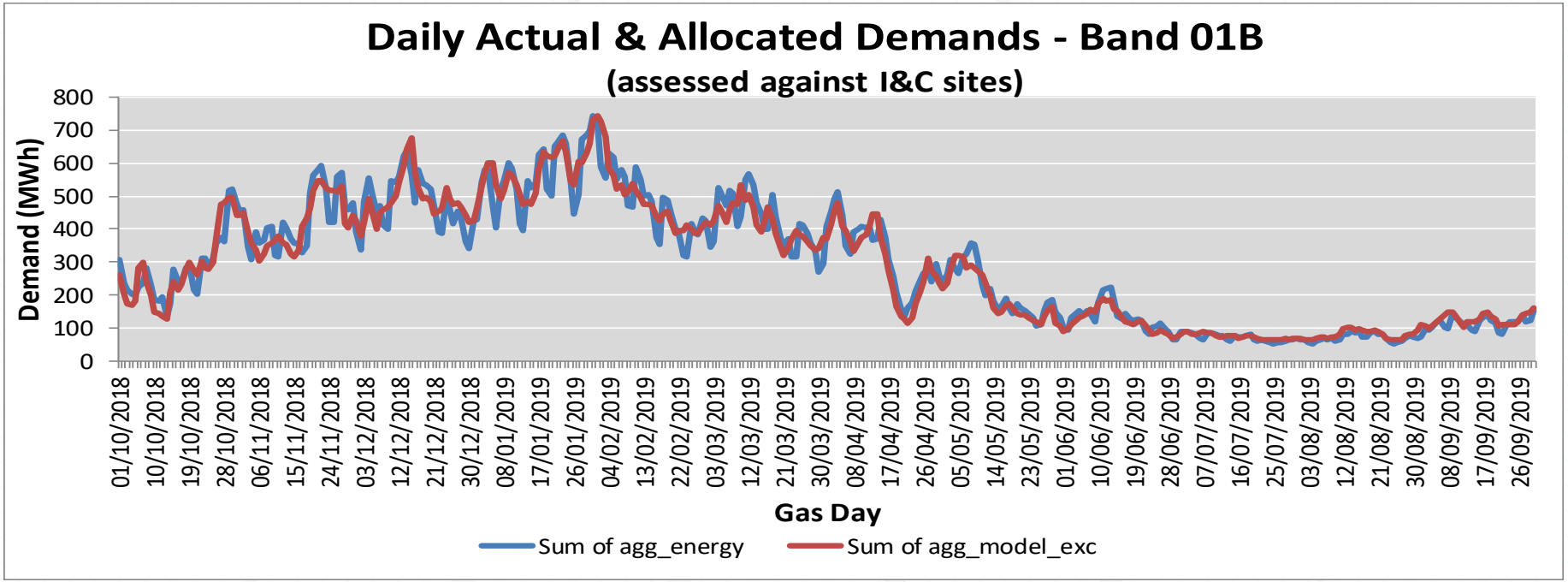
Strand 3: RETRO – EUC Band Summary



	MAPE Diff (Retro minus Model'exc')		
EUC	Winter	FullYear	Summer
01B (Dom)	-0.10%	-0.34%	-0.57%
01B (I&C)	-6.30%	-2.57%	1.15%
02B (Dom)	-3.61%	-3.85%	-4.08%
02B (I&C)	-0.96%	-1.28%	-1.59%
03B (I&C)	-1.42%	-1.43%	-1.45%
04B (I&C)	-0.49%	-0.22%	0.06%
05B (I&C)	-0.39%	0.08%	0.55%
06B (I&C)	-0.40%	0.13%	0.65%
07B (I&C)	-0.59%	-0.21%	0.17%
08B (I&C)	-0.42%	-0.13%	0.16%

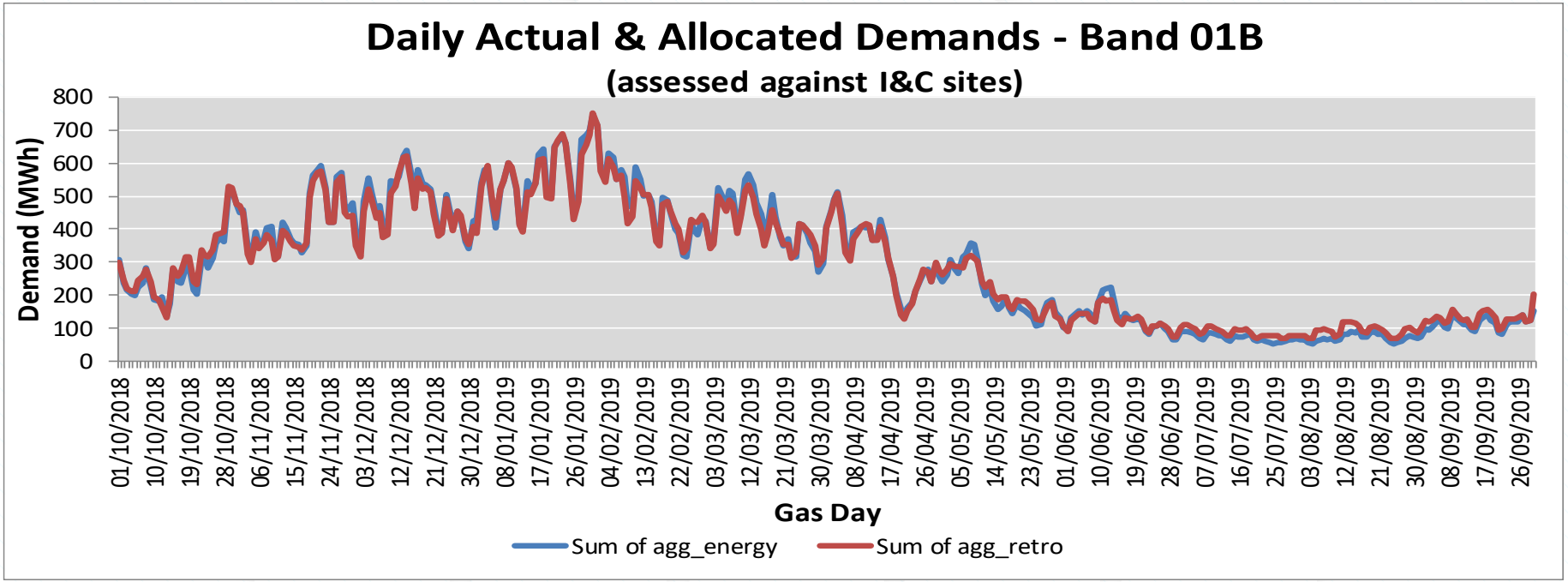
- Chart shows simple summary of the overall error on the ‘Retro’ basis
- Table shows MAPE difference compared to equivalent ‘Model(exc)’ assessment
- Full Year period errors are notably improved compared to ‘Model(exc)’ basis for all bands, with the exception of bands 05B and 06B
- Results for 01B & 02B susceptible to ‘Market Sector Code’ errors

Strand 3: RETRO – Band 01B (I&C)



- Graph shows daily actual and allocated demand for I&C sites in Band 01B (using generic 01B Domestic profile)
- This profile clearly doesn't provide a great fit for I&C customers (as it was modelled using Domestic customers)

Strand 3: RETRO – Band 01B (I&C)



- Graph shows daily actual and allocated demand for I&C sites in Band 01B (using dedicated I&C profile)
- As expected, allocation using the dedicated profile shows notable improvements and a ‘better fit’ (i.e. weekday and weekend pattern) although allocation error appears more pronounced during later part of Summer period (i.e. July to September approx.)

Strand 3: RETRO – Current vs Previous Year

Profiles	2018/19 Profiles		2019/20 Profiles		
Analysis	RETRO using 2017/18 Data		RETRO using 2018/19 Data		
EUC	Sample Count	MAPE (Full Year)	Sample Count	MAPE (Full Year)	vs Previous Year
01B (Dom)	2,713	10.28%	2,450	8.69%	-1.59%
01B (I&C)	2,781	16.67%	3,267	12.05%	-4.62%
02B (Dom)	23	33.47%	102	14.81%	-18.66%
02B (I&C)	4,916	10.94%	4,731	6.87%	-4.07%
03B (I&C)	3,387	10.49%	3,040	6.37%	-4.12%
04B (I&C)	3,211	6.96%	3,147	5.71%	-1.25%
05B (I&C)	1,347	6.59%	1,404	6.02%	-0.57%
06B (I&C)	498	7.61%	487	8.00%	0.38%
07B (I&C)	168	14.74%	184	14.09%	-0.65%
08B (I&C)	75	12.84%	78	17.52%	4.68%

- Table shows comparison of Full Year MAPE by EUC against the equivalent analysis from the previous year, on the ‘Retro’ basis
- Green denotes an improvement; Red denotes a worsening
- All bands show improvement with the exception of bands 06B & 08B

Strand 3: Conclusions – Algorithm Accuracy

NDM Daily Demand Analysis suggests:

- The algorithms which applied for Gas Year 2018/19 did a good job of influencing UIG levels but did not improve the accuracy of NDM allocation. The full year MAPE values improved when using the models without uplifts (except 07B & 08B were marginally worse)
- Assessment of the 2019/20 algorithms showed further improvements in most of the 'B' bands

Analysis of New EUC Profiles

- Allocation using dedicated profiles for I&C sites in Band 01B and Domestic sites in Band 02B showed clear improvement and supports DESC's decision to introduce these new EUCs
- However, to fully utilise these new profiles, shippers must ensure the 'Market Sector Flag' held on UKLink is relevant for their portfolios

Strand 3: Conclusions – Modelling Approach

Modelling Approach for Gas Year 2020/21 (in Spring 2020):

- Strand 3 analysis suggests that new EUC definitions in bands 01B and 02B should continue

- Use of the new CWV (which includes solar radiation) will hopefully help to further improve the accuracy of the demand modelling

- Reminder that DESC members will have the opportunity to review and influence the modelling approach in 2020