Demand Estimation Sub Committee

NDM Algorithm Performance (Gas Year 2019/20)
Strand 3 – NDM Daily Demand Analysis

7th December 2020

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 2019/20
- 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 by shippers

Strand 3: Things to Consider

In 2019, DESC approved the continued application of ‘Uplifts’ to the Gas Year 2019/20 demand profiles, specifically the Daily Adjustment Factor (DAF) . The Annual Load Profile (ALP) ‘Uplift’ used in Gas Year 2018/19 was not applied.

This resulted in uplifts being applied to DAFs for all EUC Bands for Gas Year 2019/20.

See ‘NDM Demand Estimation Methodology’ document at this link for details

Strand 3: Approach

Analysis has taken the following approach:

- Daily NDM consumption data obtained for Gas Year 2019/20
- Validation applied to all daily NDM consumption data in order to exclude sites with suspicious or erroneous data
- Calculate the % error of allocation against:
  - **MODEL**: Allocated using
    - NDM sample derived AQs
    - 2019/20 ALPs and DAFs (including 'Uplift' factors) and
    - 2019/20 Weather Correction Factors (WCF)
  - **RETRO**: Allocated using
    - NDM sample derived AQs
    - 2020/21 ALPs and DAFs (adjusted to day/holiday pattern in 2019/20) and
    - Recalculated WCFs using the new seasonal normal basis
- 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 2019/20 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	2,374	9,379	24,844	36,597
Final SP Count of Usable Data	1,894	5,872	14,574	22,340
% Deemed Usable	80%	63%	59%	61%

Strand 3: Source Data - Breakdown

EUC	LDZ													Total Supply Points	Data Source	
	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW		% Non-Third Party	% Third Party
01BND	392	349	390	376	395	403	204	328	370	351	360	416	428	4762	29%	71%
01BNI	531	206	333	218	262	247	35	106	289	248	347	192	201	3215	5%	95%
01BPD	25	25	64	26	52	39	7	14	19	26	4	19	11	331	0%	100%
02BND	22	6	12	13	13	6	.	2	6	9	13	9	10	121	74%	26%
02BNI	971	253	523	321	568	495	54	147	434	460	566	414	386	5592	19%	81%
03B	781	166	227	191	226	186	29	65	203	247	324	234	194	3073	40%	60%
04B	631	216	260	277	201	207	36	85	220	234	389	297	172	3225	67%	33%
05B	223	104	106	132	84	115	18	33	78	140	139	107	59	1338	81%	19%
06B	77	33	36	51	43	44	6	18	24	28	40	42	20	462	92%	8%
07B	17	10	17	20	24	18	1	2	6	5	5	13	9	147	95%	5%
08B	5	3	3	5	13	6	1	3	5	7	6	3	4	64	91%	9%
09B	5	2	1	.	.	.	.	.	.	.	.	2	.	10	80%	20%
Totals	3680	1373	1972	1630	1881	1766	391	803	1654	1755	2193	1748	1494	22340		

- 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 (data issues) or Band 09B (not a valid NDM EUC)

Strand 3: Data Issues

- There were a number of data issues with the 3rd Party provided data which have been identified during the analysis, these include:
  - Negative volumes
  - Volume spikes
  - Large numbers of consecutive missing volumes
  - Consumption grouped to a single day
  - Duplicates
  - Gas Day submitted not ‘Meter Read Day’
  - Incorrect Market Sector Code on UK Link

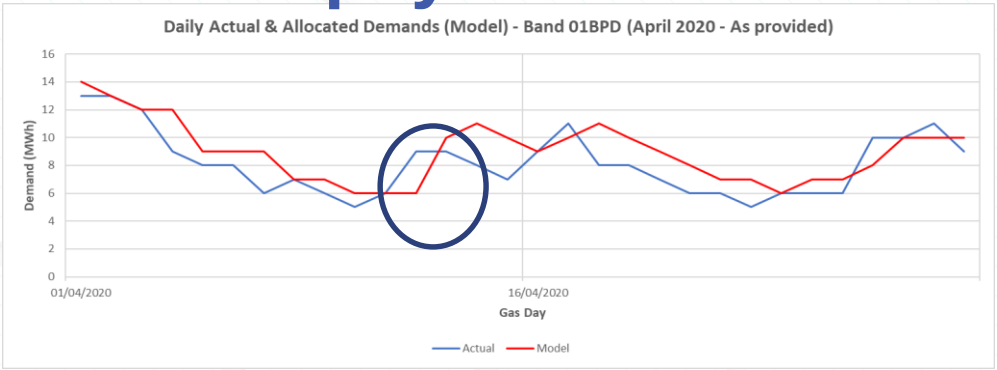
- It would be very helpful if future 3rd Party submissions could be checked before sending to Xoserve

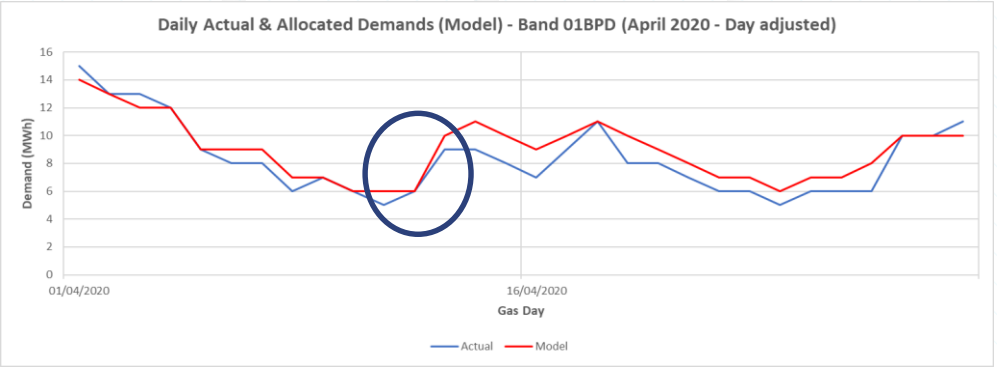
- For more information on these checks, a presentation can be found on the Joint Office website here

- Future data collection and validation will be performed using a new system which is likely to reject any submissions which contain numerous data errors

Strand 3: Data issue – Prepayment Data

- We received 331 MPR of Prepayment data and these were confirmed by the sender as being in Prepayment mode
- Validation highlighted a few points
- None of the MPRs were on UK Link in prepayment EUCs (or had the flags to trigger being assigned to those EUC)
- There was a day of the week inconsistency :
  Top chart is the data as provided (limited to April 2020)
  The bottom chart is the data adjusted a day.
- Despite these issues we decided to still analyse the datasets due to lack of PPM data avaialbility





Strand 3 – NDM Daily Demand Analysis

Gas Year 2019/20 Results

Strand 3: Observations / Assumptions (1)

- Analysis includes (where numbers have allowed) a review of the new EUCs introduced in Gas Year 2019/20 following the implementation of XRN4665
- These relatively new EUCs are reliant on the key data held in UK Link being correct, namely Market Sector Codes, Meter Type and Payment Method
- Analysis of trends excluding DAF uplifts are not considered
- The analysis period is impacted by the Covid-19 pandemic and several key date ranges have been observed :
  - 1st October 2019 – 22nd March 2020
  - 23rd March 2020 – 14th May 2020 – noticeable change in demand levels during National Lockdown
    ** Spring Modelling identified impact from 23rd March 2020 to 31st March 2020
  - 15th May - 30th September 2020 – Impacted demand levels due to more localised restrictions
- Charts have been prepared to try and show demand trends in these date ranges

Strand 3: Observations / Assumptions (2)

- The analysis uses a calculated AQ from the 12 months of consumption
- This is the most up to date view of an AQ and is used to calculate an allocation value using the ALP and DAF profiles
- The pandemic and the pattern of demand have highlighted a possible limitation in this approach in handling wide spread demand changes
- This is supported by the changes to the Population AQ, especially the I&C sector, which is provided in the table

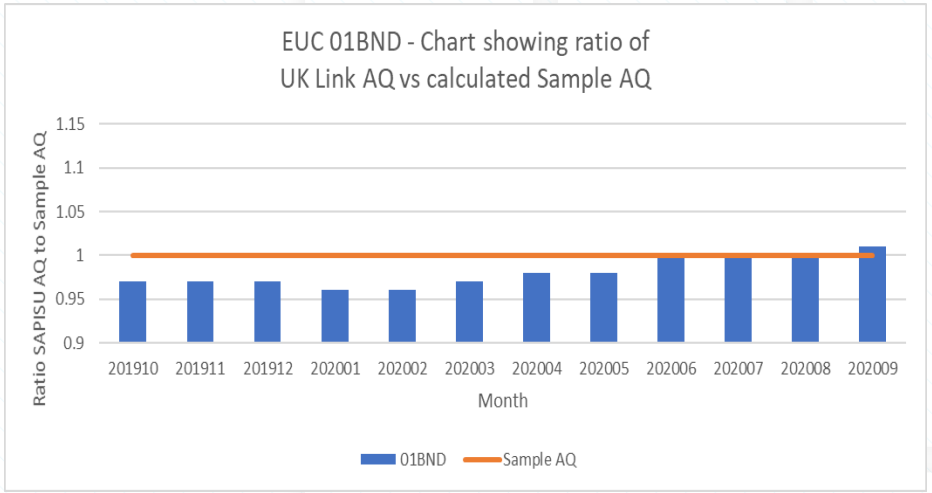
EUC	From Oct 2019 to Apr 2020	From Apr 2020 to Sep 2020
DOM	0.3%	1.0%
I&C	0.2%	-4.3%

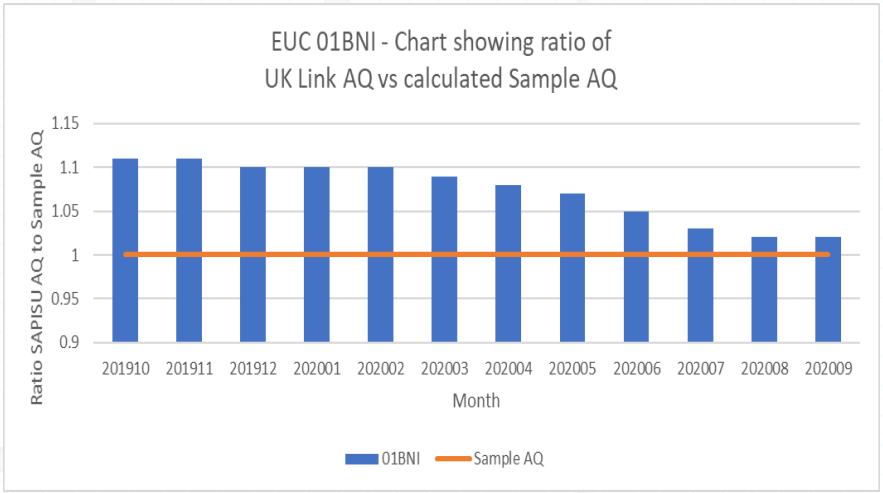
- This impact could support result interpretation, for example, could an under allocation in winter be caused by lower pandemic affected AQs

Strand 3: Observations / Assumptions (3)

- These charts show a ratio of the UK Link AQ for the sample sites for an EUC against a calculated AQ from demand data

- Charts confirm that generally Domestic AQs have risen in the sample and I&Cs have decreased. Sample AQ will be applied the same every month

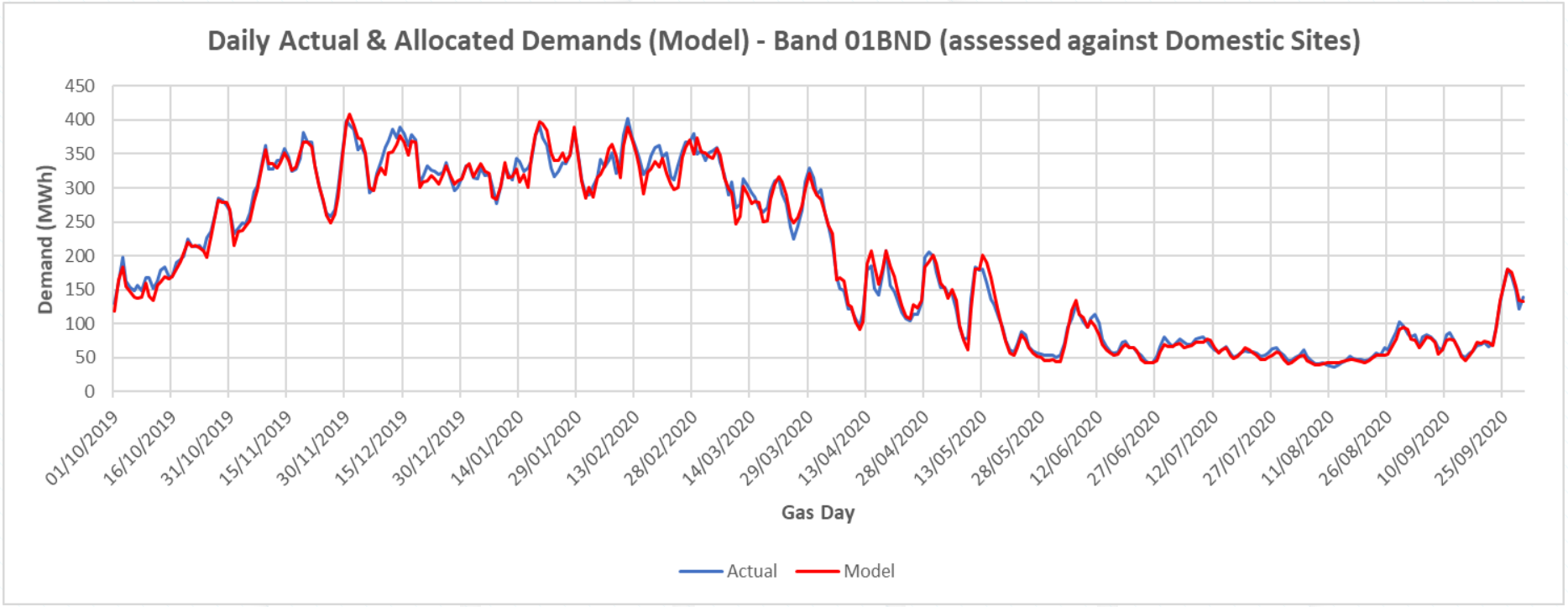




Strand 3 – NDM Daily Demand Analysis for all EUCs

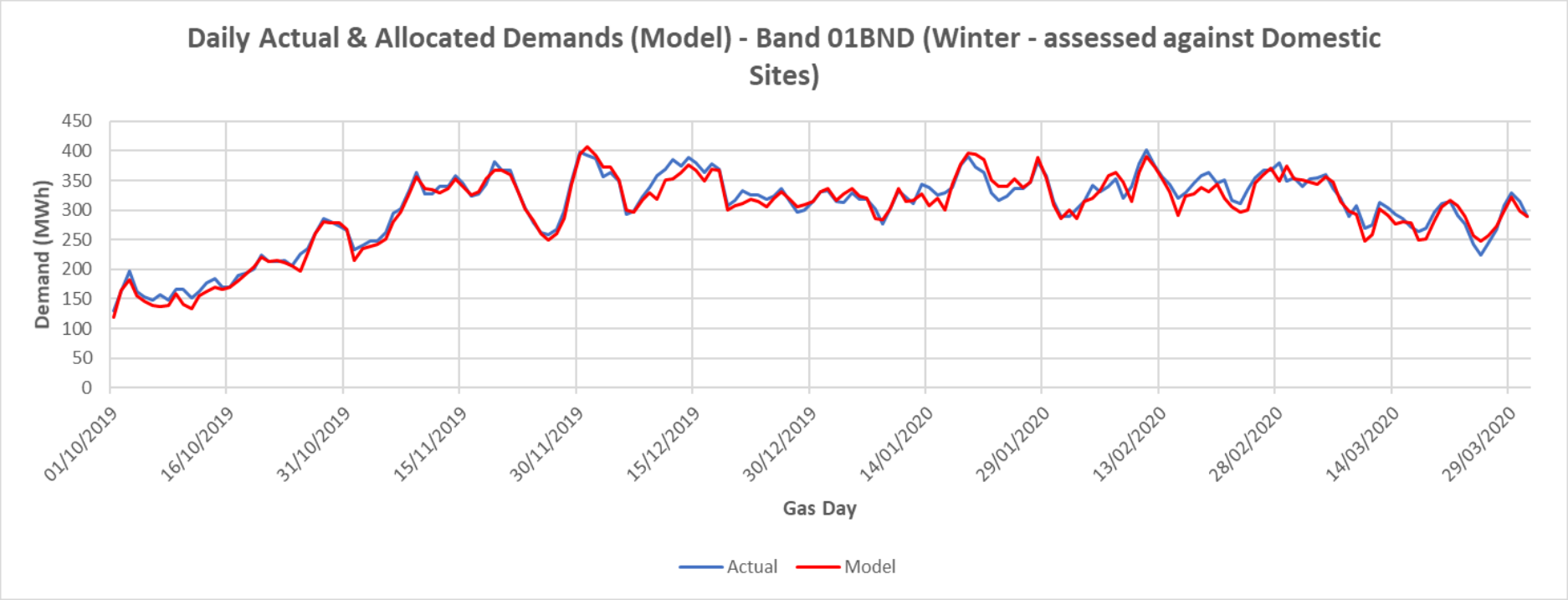
Selected EUCs Results
01BND, 01BPD (unadjusted)
01BNI, 03B and 05B

Strand 3: MODEL – Band 01BND



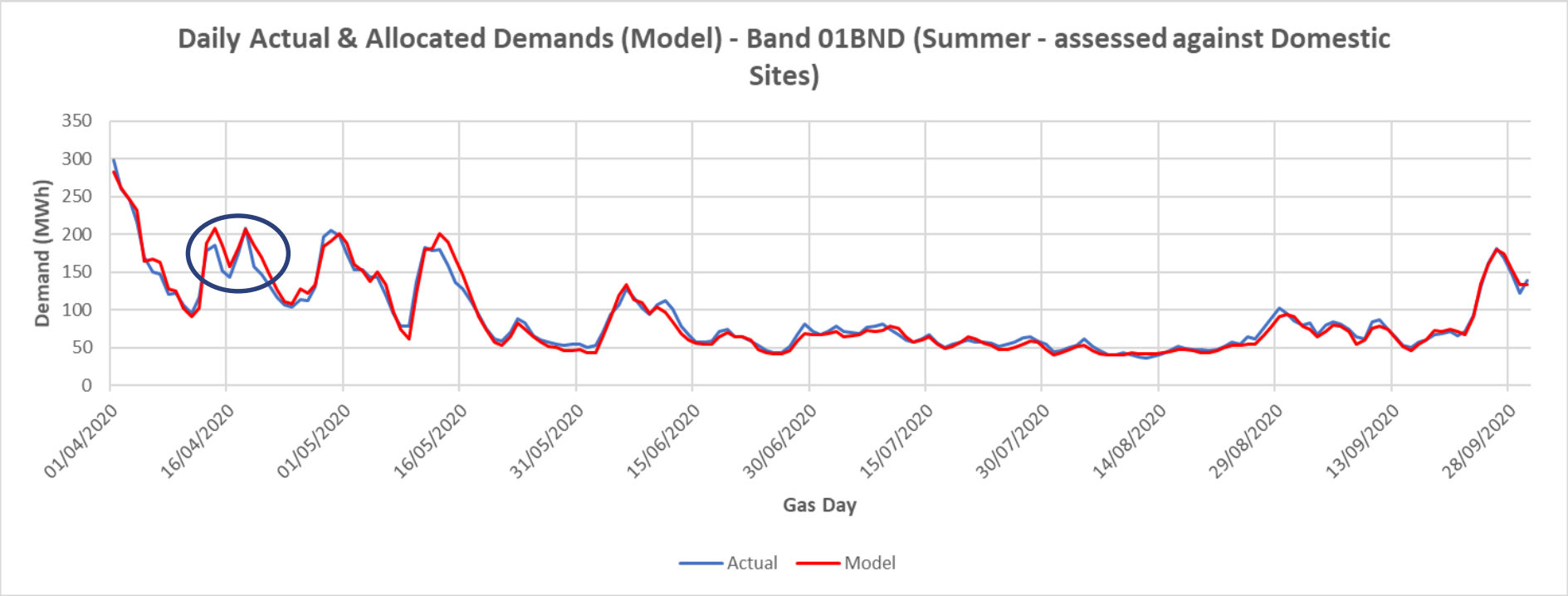
- Graph shows daily actual and allocated demand on Model basis for the full year (Band 01BND; Domestic sites) with the shape following the actual demand closely
- The following charts break the year into Winter and Summer

Strand 3: MODEL – Band 01BND



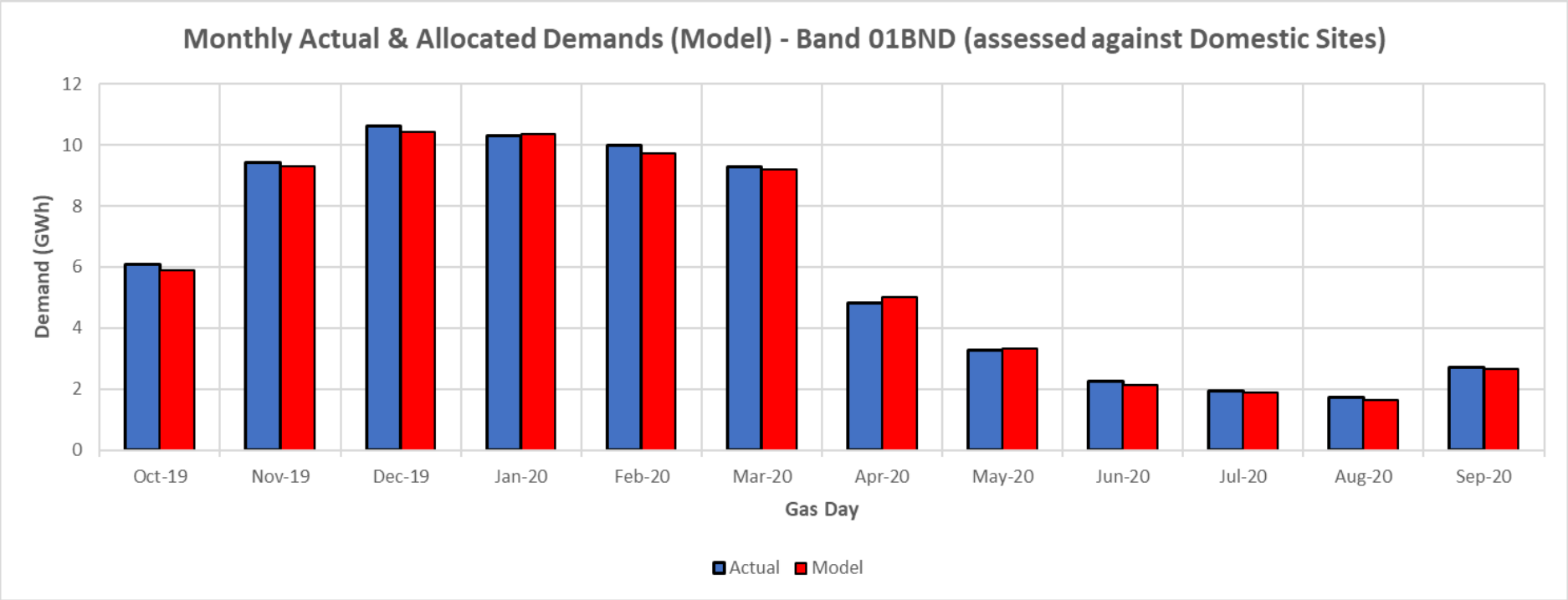
- Daily actual and allocated demand on Model basis for Winter (Band 01BND; Domestic sites)
- Tracks closely to the actual demand with the tendency, if any, to under allocate with the more notable periods in December 2019 and in February 2020.
- The exception would be 20th -27th of January 2020 which saw a period of over allocation

Strand 3: MODEL – Band 01BND



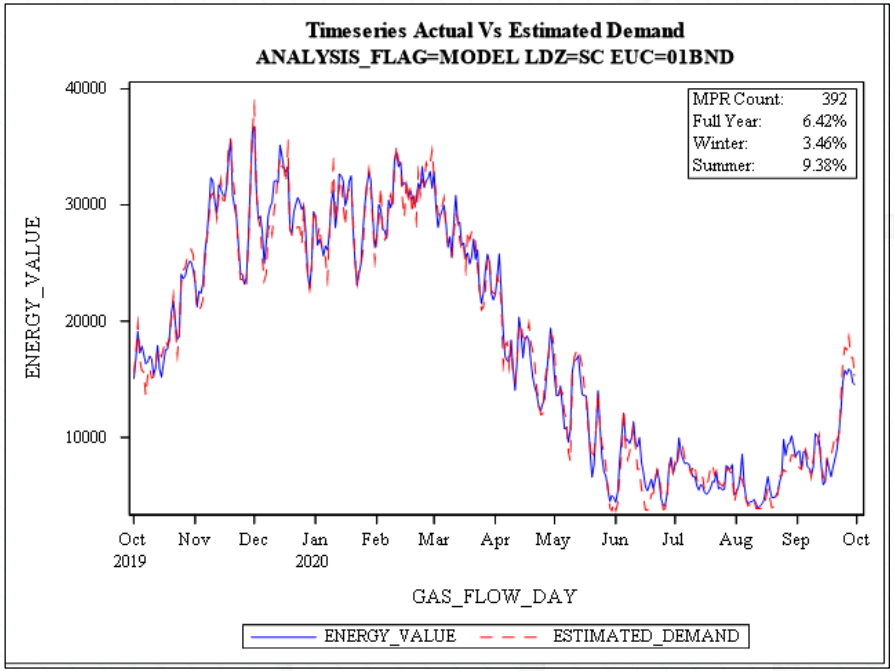
- Graph shows same assessment as previous graph but for Summer period
- This is tracking very closely with an net over allocation throughout most of Summer period
- Most notable periods of over allocation occurred during 11th to 24th April 2020 (3rd warmest April in last 50 years) and 15th to 17th May 2020.

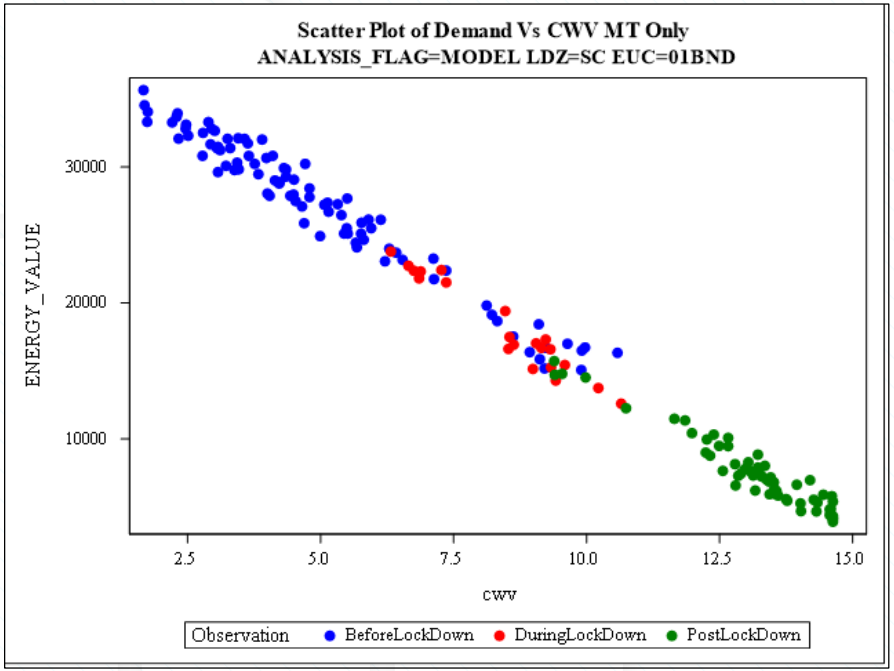
Strand 3: MODEL – Band 01BND



- Chart shows aggregated monthly actual and allocated demand for Band 01BND
- They are trending closely with an under allocation in winter months except in January 2020.
- For the summer months an over allocation was present in Apr 2020 and May 2020 with the remaining months having marginal under allocation

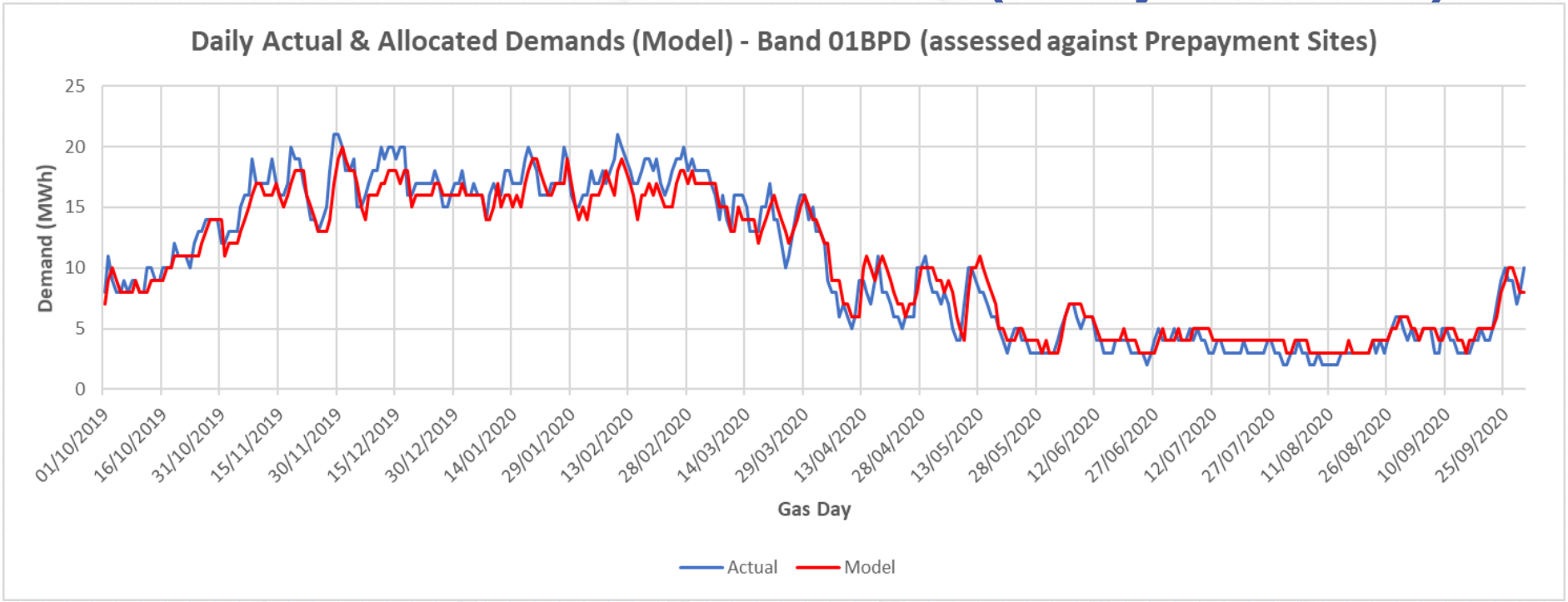
Strand 3: MODEL – SC Band 01BND





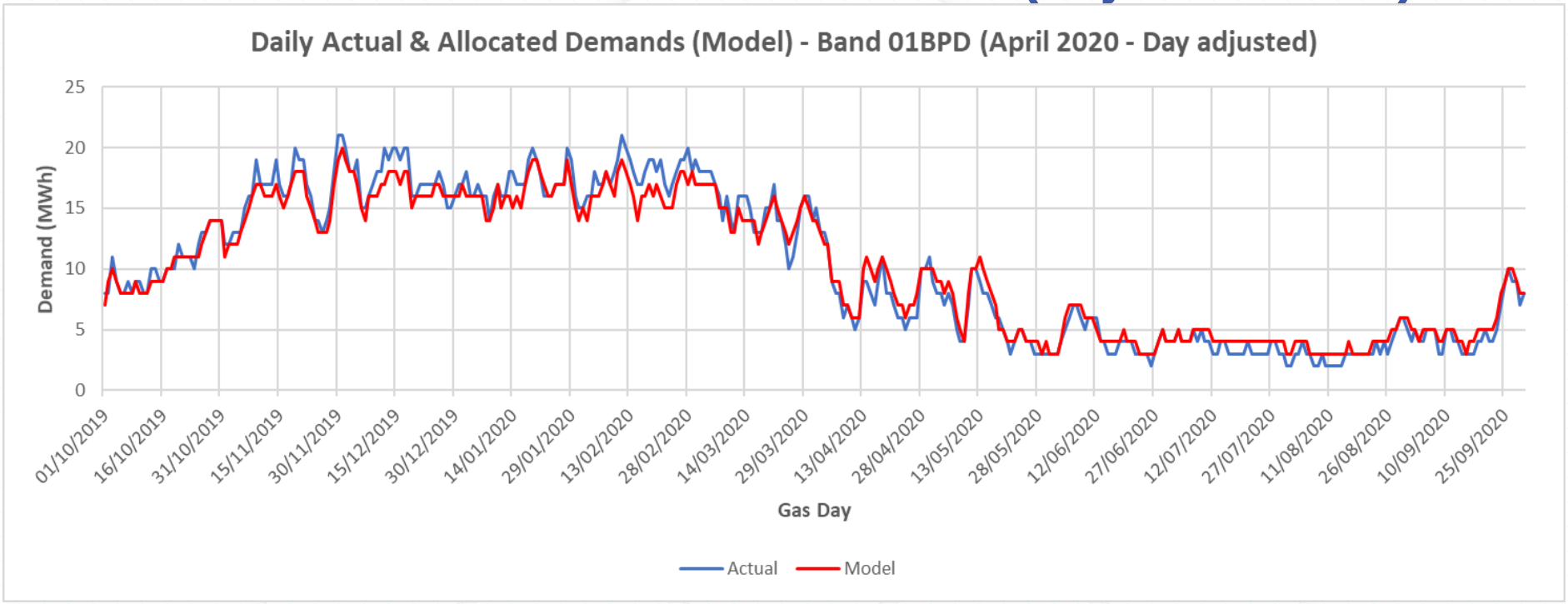
- The timeseries for SC LDZ for band 01BND shows generally good performance of the profile.
- The scatter plot (Mondays – Thursdays non holidays) shows a consistent trend in demand, before, during and post the National lockdown

Strand 3: MODEL – Band 01BPD (unadjusted data)



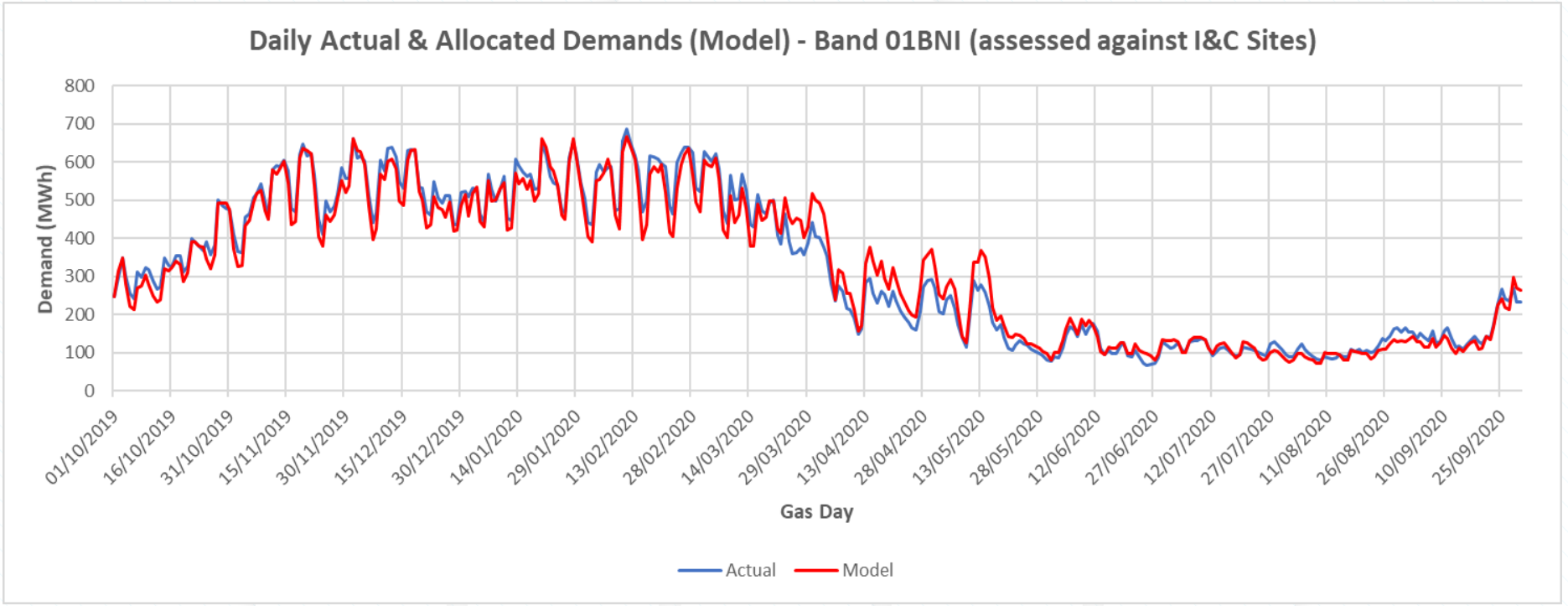
- Graph shows daily actual and allocated demand on Model basis for the full year (Band 01BPD; Domestic Prepayment sites), appears to show a ‘day of the week’ issue

Strand 3: MODEL – Band 01BPD (adjusted data)



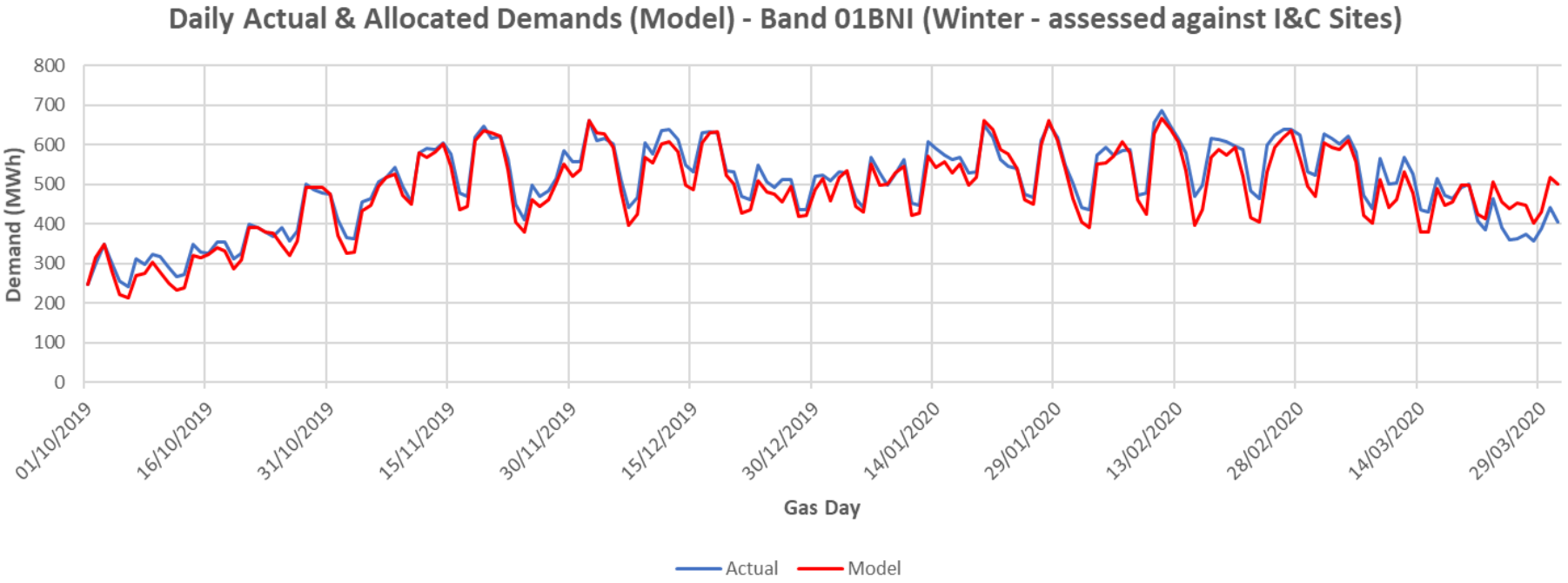
- Graph shows daily actual (adjusted by one day) and allocated demand on Model basis for the full year (Band 01BPD; Domestic prepayment sites) with the allocation shape showing a strong link to actual demand
- The 01BPD profile is based on very old sample data, however it appears to be a reasonable match to the actual demand. We still need to ensure that in Spring 2021 we use more upto date PPM sample data

Strand 3: MODEL – Band 01BNI



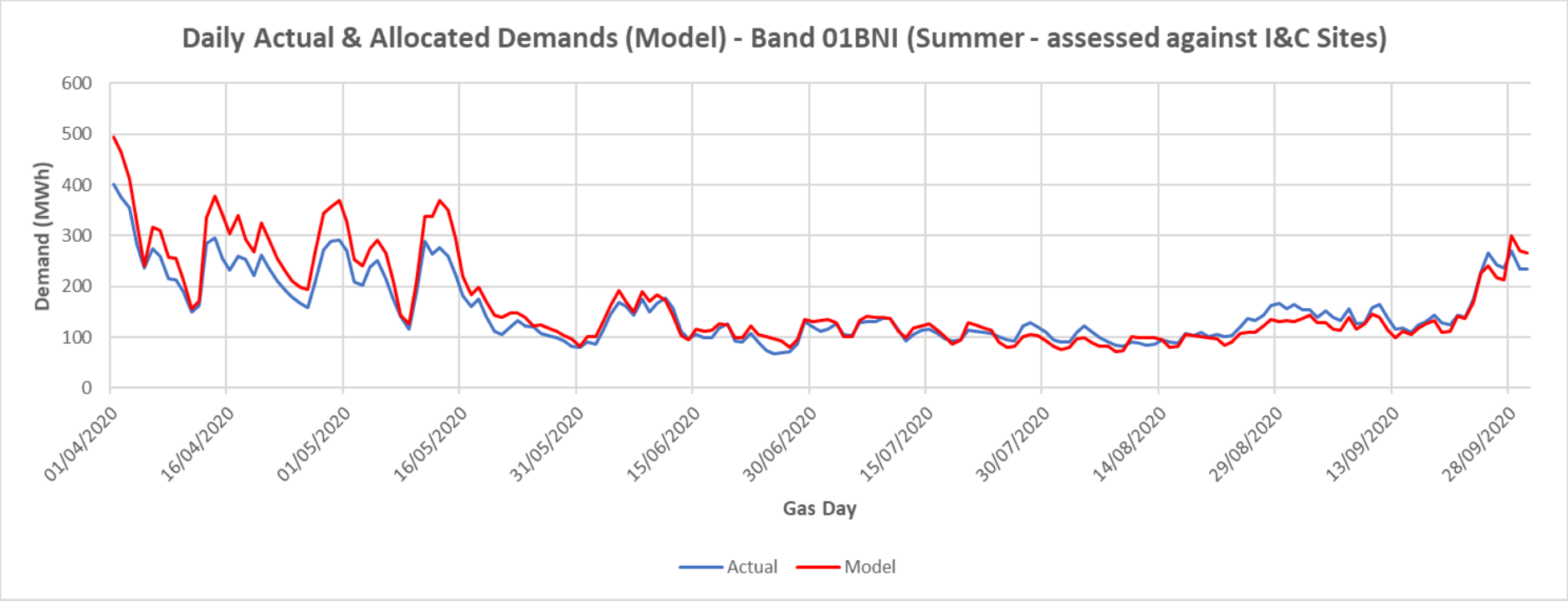
- Graph shows daily actual and allocated demand on Model basis for the full year (Band 01BNI; I&C sites)
- This is the first time this EUC Band has been analyzed and the shape follows the actual demand closely
- The following charts break the year into Winter and Summer

Strand 3: MODEL – Band 01BNI



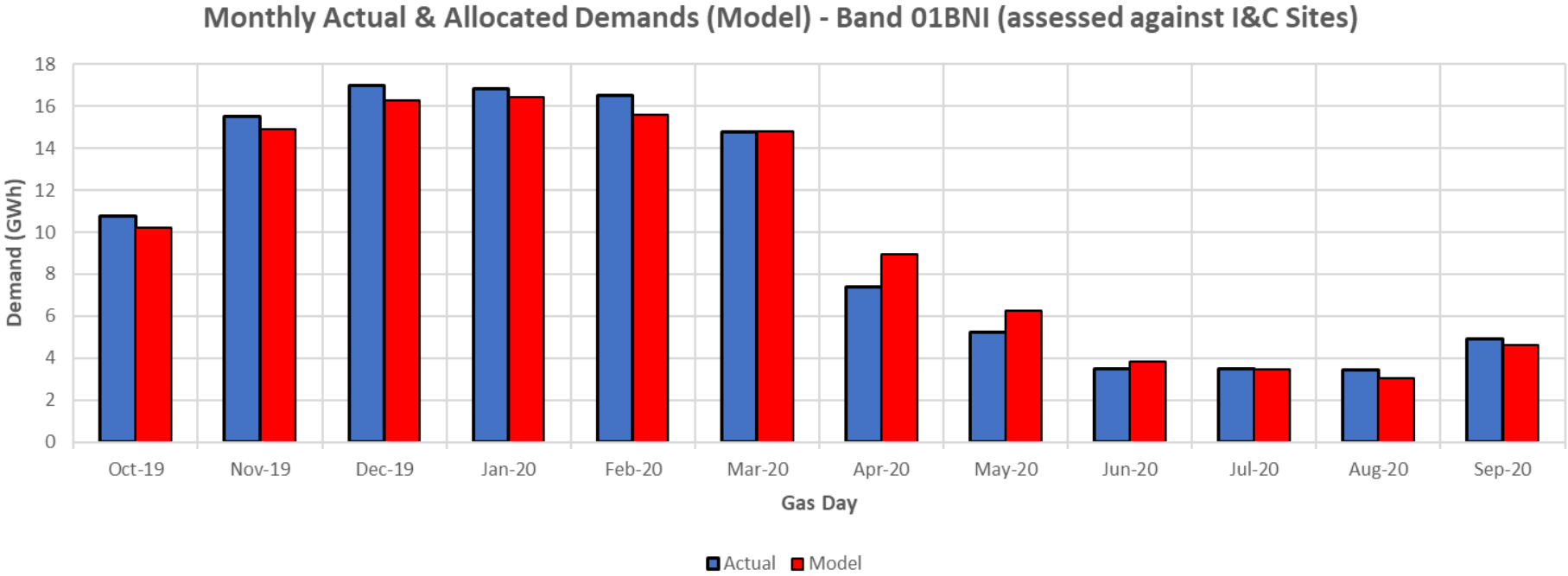
- Graph shows daily actual and allocated demand on Model basis for Winter (Band 01BNI, I&C sites)
- Tendency of under allocation throughout most of Winter period.
- However the 23rd March 2020 signalled start of a period of over allocation, which coincided with the start of the National lockdown

Strand 3: MODEL – Band 01BNI



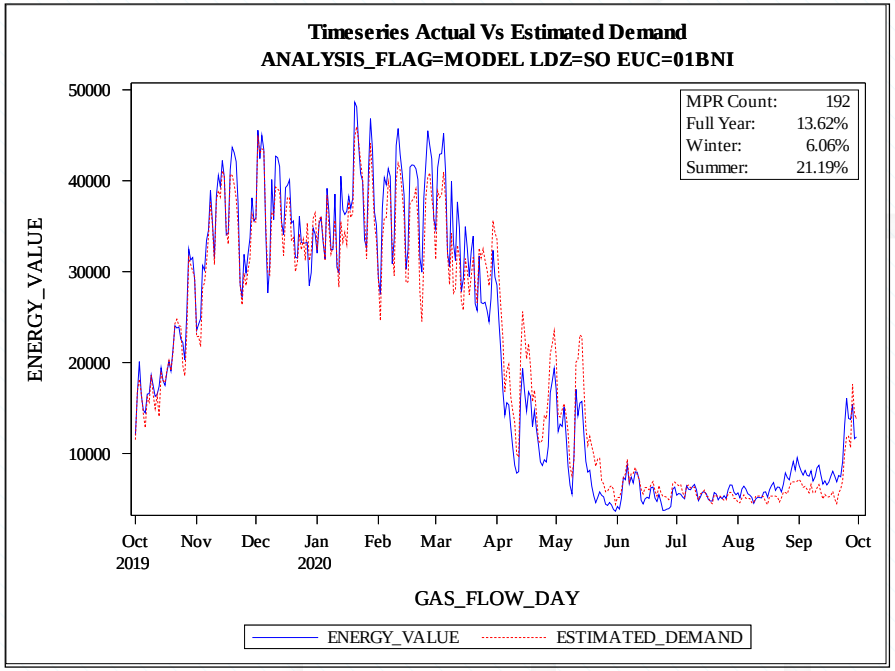
- This plot for the Summer period mainly continues the trend of over allocation, with the extent of the over allocation starting to diminish from mid to end of May 2020.
- There were two noticeable periods of under allocation between 24th July 2020 to 8th Aug 2020 and 21st Aug 2020 to 14th Sep 2020.

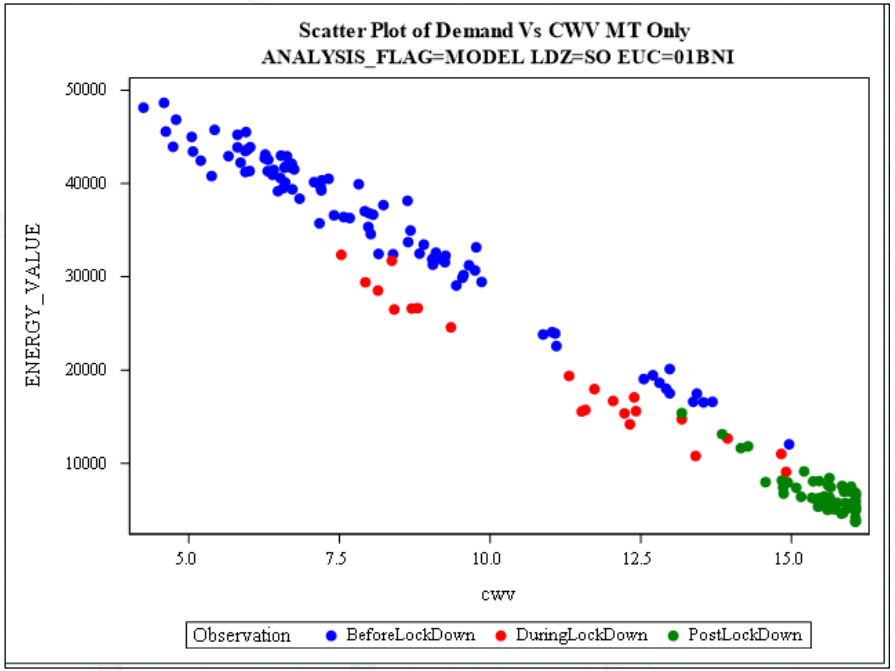
Strand 3: MODEL – Band 01BNI



- Chart shows aggregated monthly actual and allocated demand for Band 01BNI
- There is a clear under allocation in winter months except for March 2020.
- For the summer months an over allocation was present between Apr 2020 and Jun 2020 with the remaining months having marginal under allocation

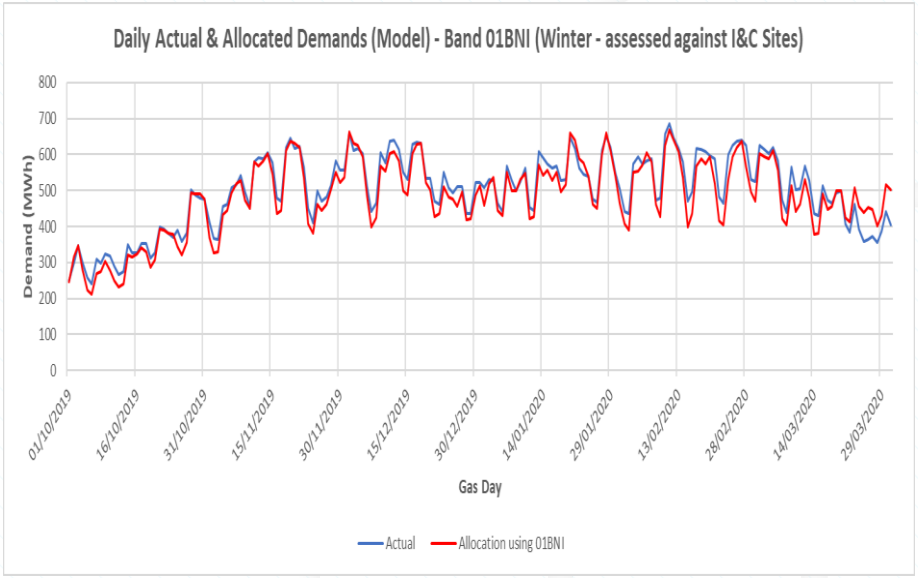
Strand 3: MODEL – SO Band 01BNI

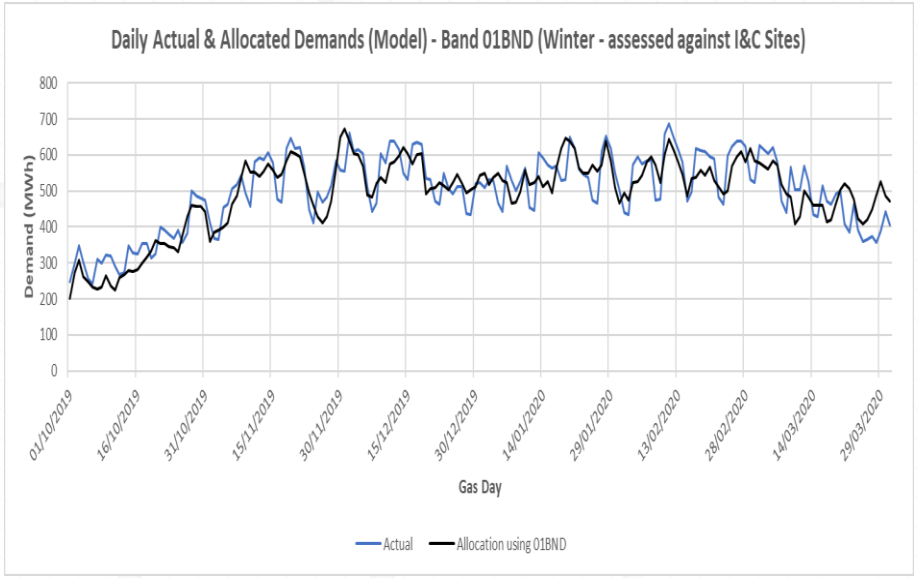




- SO LDZ for band 01BNI is characterised by under allocation in winter with an over allocation from end March onwards.
- The scatter plot shows a distinct different trend specifically during the National lockdown period (23rd March to 14th May)

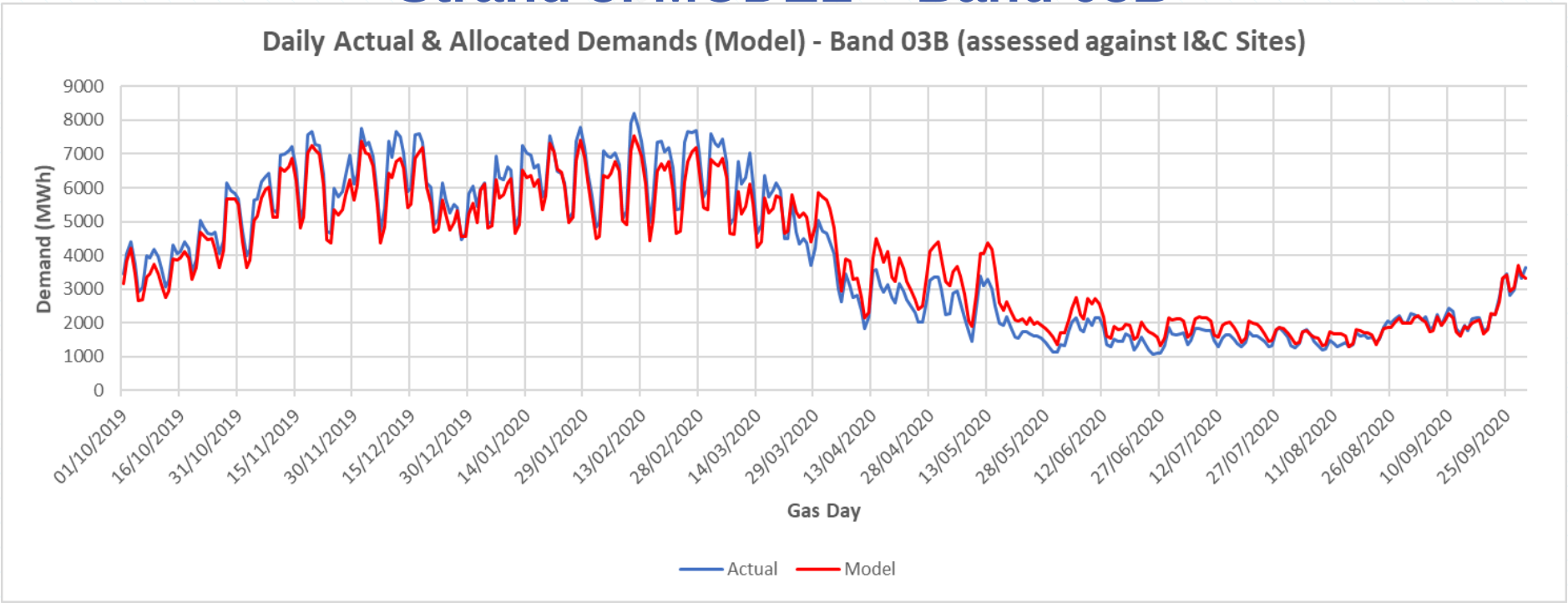
Strand 3: MODEL – Band 01BNI Tested against 01BND





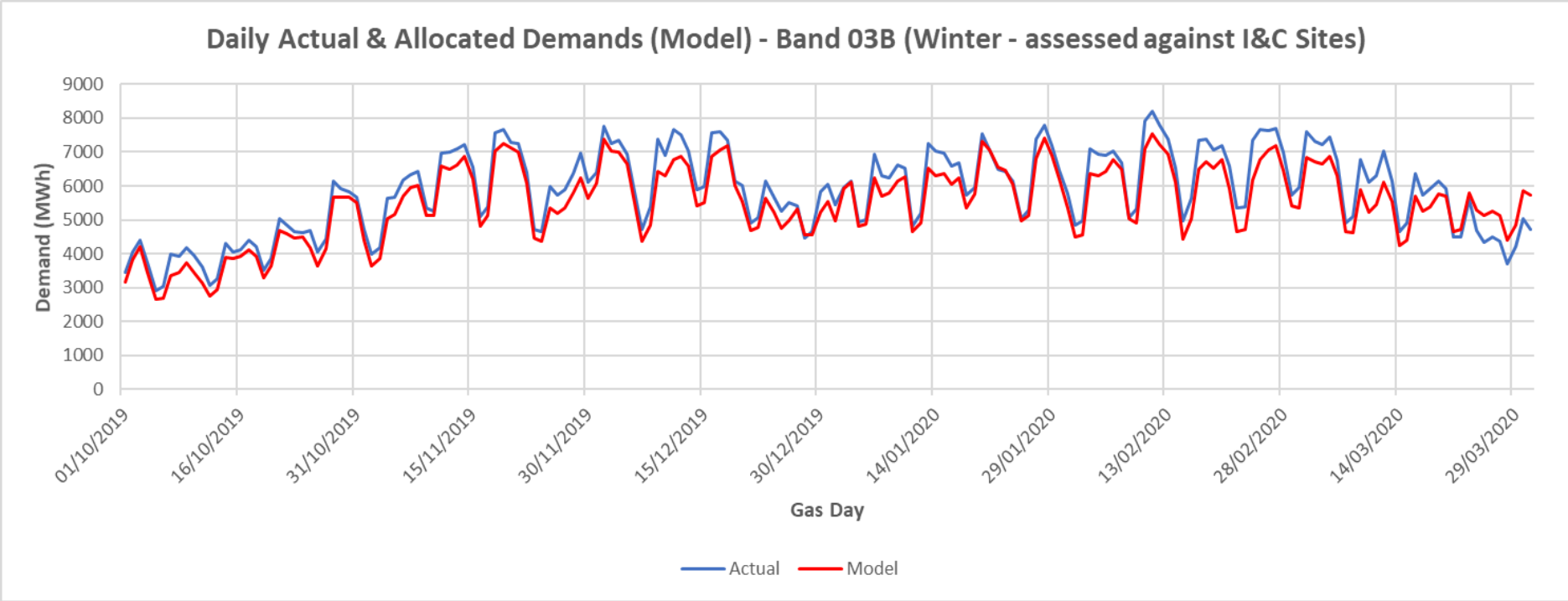
- These charts show a comparison of the 01BNI sites against its assigned EUC (left) and the 'traditional' 01BND profile (right).
- The results confirm that the decision to introduce more refined EUCs into Bands 1 and 2 was necessary
- There are circa 560,000 meter points now benefiting from a more appropriate I&C profile (as at 1st Nov 2020).

Strand 3: MODEL – Band 03B



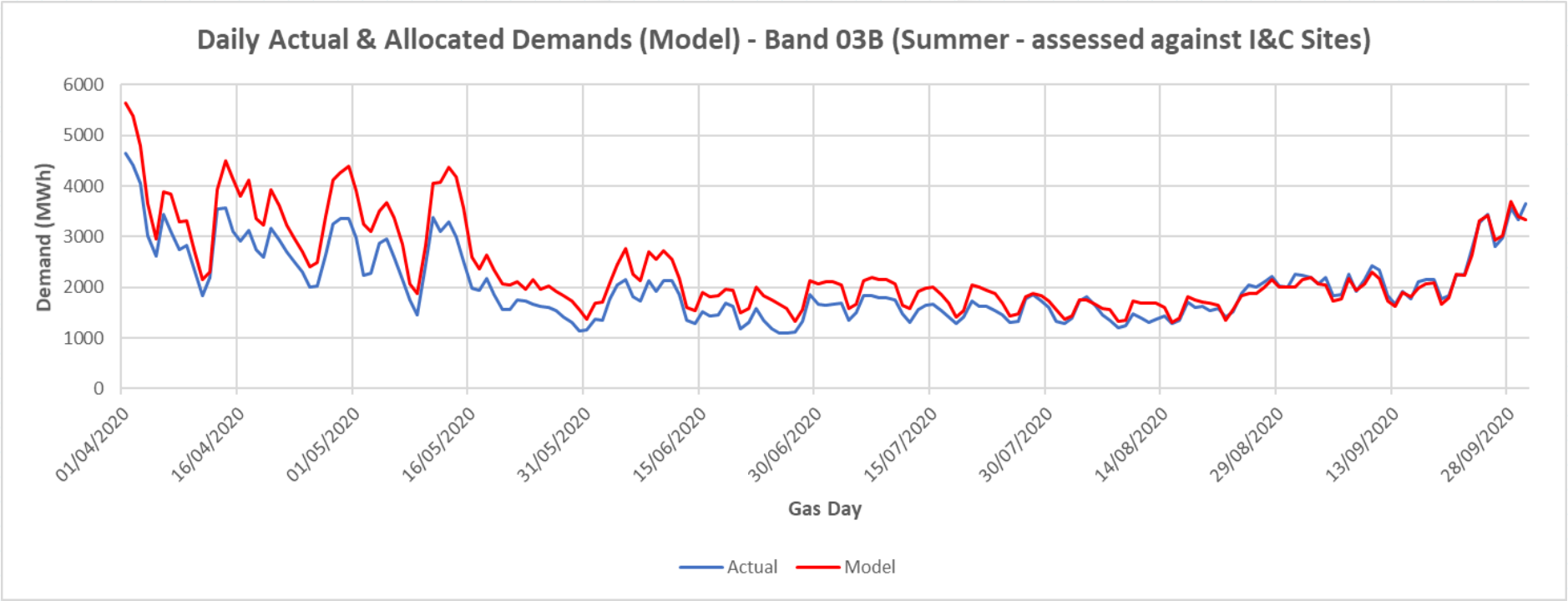
- Graph shows daily actual and allocated demand on Model basis for the full year (Band 03B; I&C sites)
- Generally the shape follows the actual demand well, albeit at a level change(which is possibly due to AQ of the sample data)
- The following charts break the year into Winter and Summer

Strand 3: MODEL – Band 03B



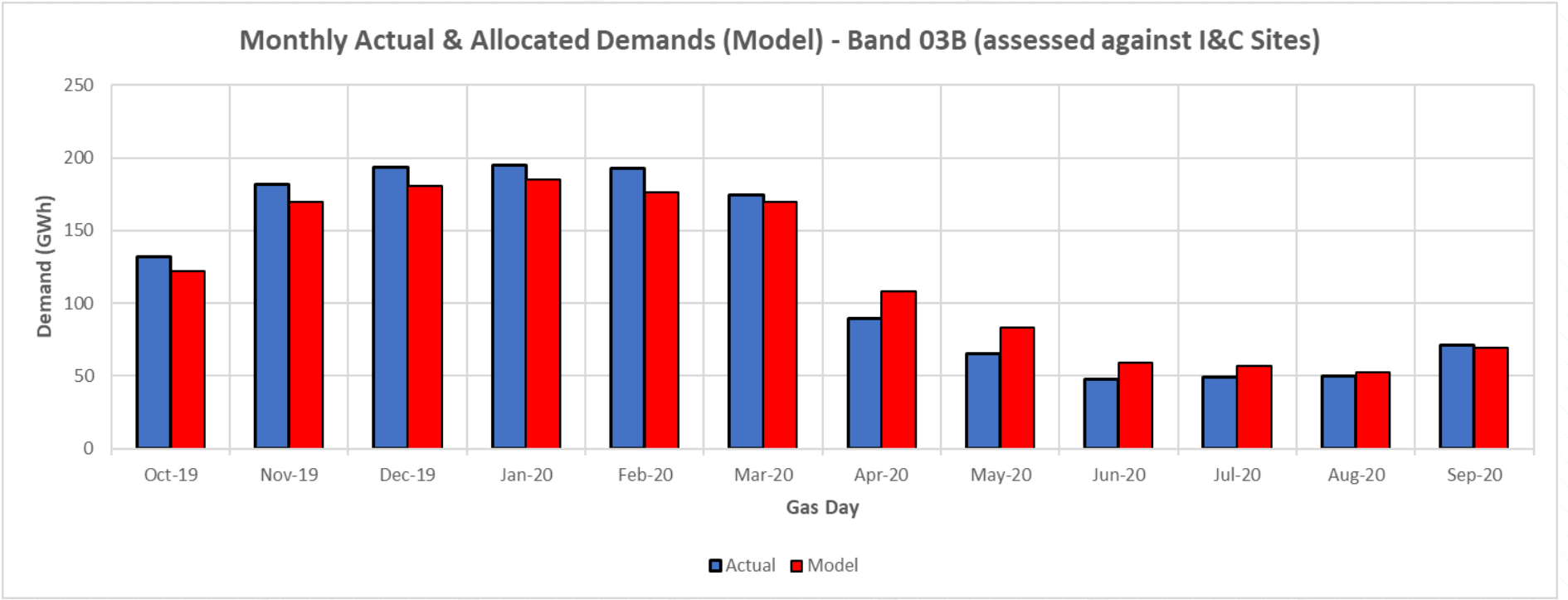
- Graph shows daily actual and allocated demand on Model basis for Winter (Band 03B; I&C sites)
- Pattern of under allocation throughout most of Winter period (potentially Sample AQ reflecting the pandemic influenced demand could mean it is low compared to genuine levels at the particular day/time of the year).
- The 23rd March 2020 signalled a period of over allocation, coinciding with the start of the National lockdown

Strand 3: MODEL – Band 03B



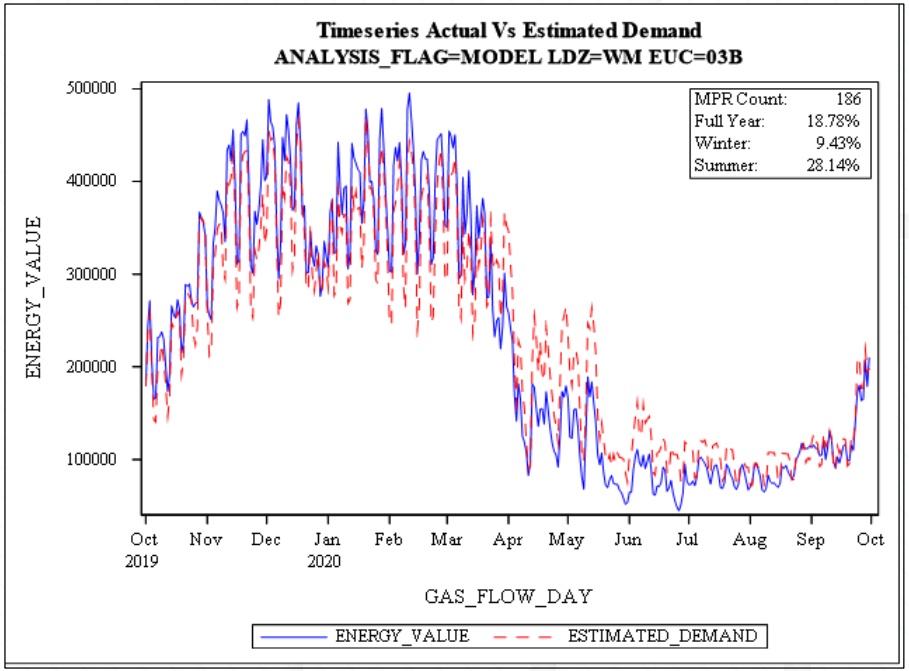
- This plot for the Summer period mainly continues the trend of over allocation, with the extent of the over allocation only starting to diminish from end of July 2020
- There was a minor period of under allocation between 25th Aug 2020 to 2nd Sep 2020

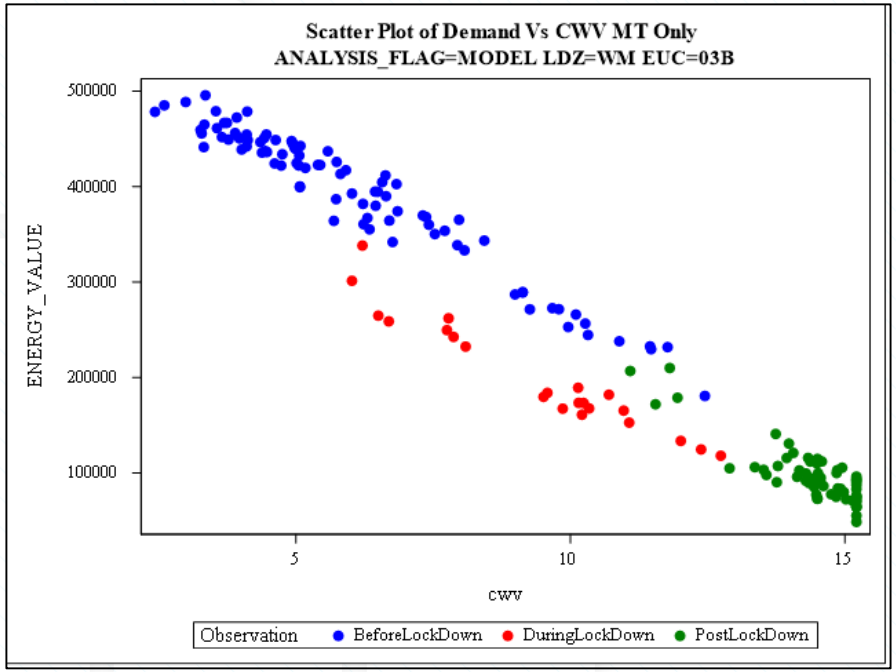
Strand 3: MODEL – Band 03B



- Chart shows aggregated monthly actual and allocated demand for Band 03B
- There is a clear under allocation in all winter months
- For the summer months an over allocation was present between Apr 2020 and Aug 2020 but at a diminishing rate for each month. Sep 2020 showed a marginal under allocation

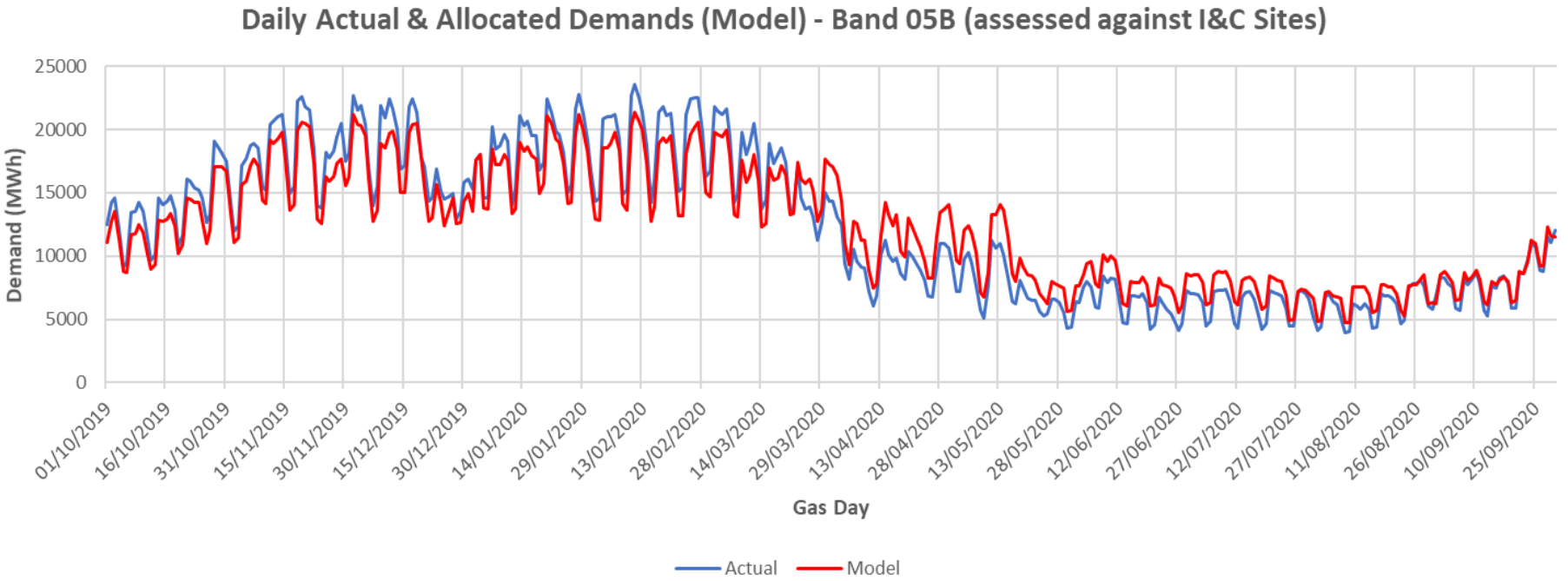
Strand 3: MODEL – WM Band 03B





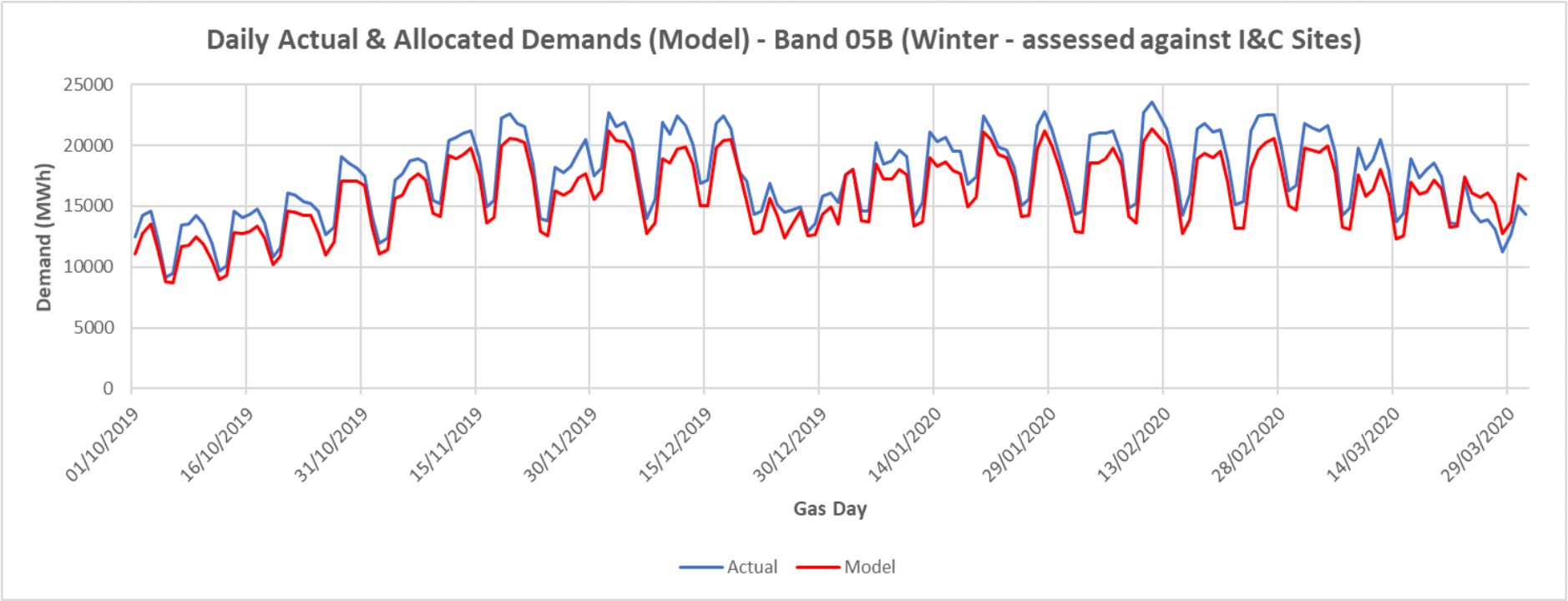
- WM LDZ for band 03B is characterised by under allocation in winter with an over allocation from April onwards
- The scatter plot (Monday to Thursdays non holidays) shows graphically the materially different trend during and post the lockdown

Strand 3: MODEL – Band 05B



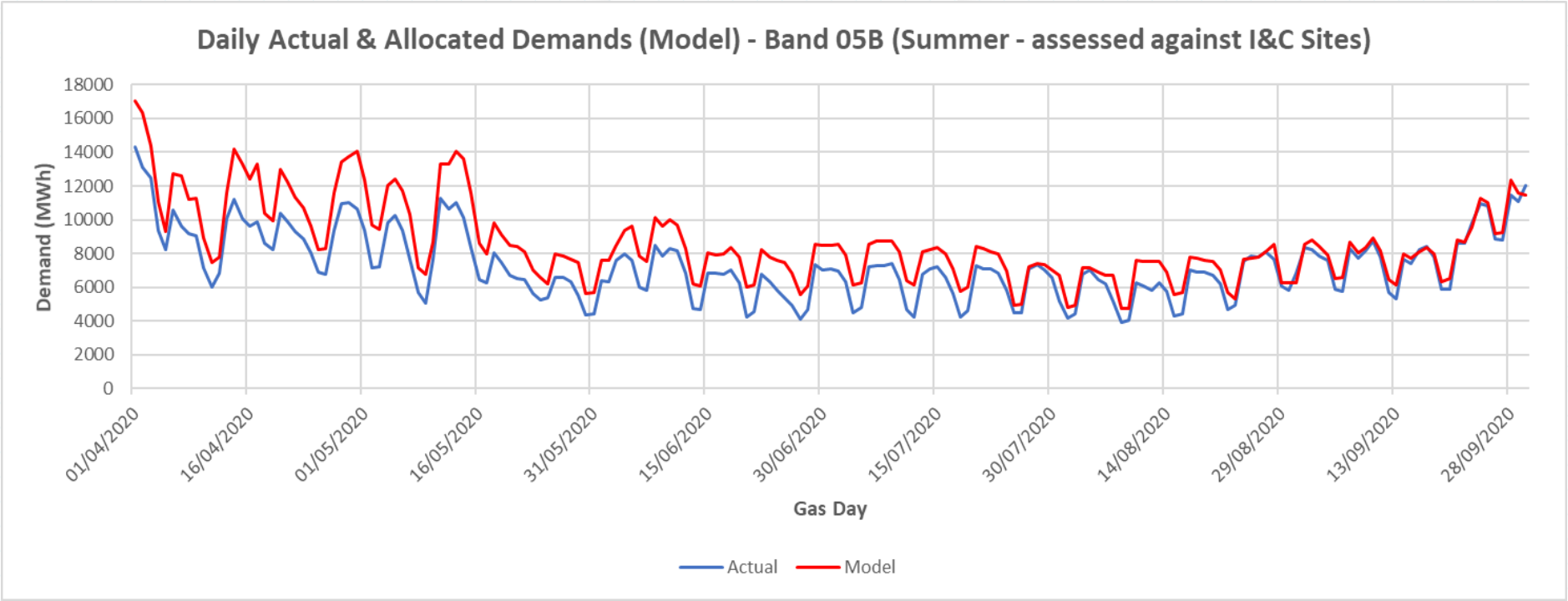
- Graph shows daily actual and allocated demand on Model basis for the full year (Band 05B; I&C sites)
- Generally the shape follows the actual demand well, albeit at a level change (which is possibly due to AQ of the sample data)
- The following charts break the year into Winter and Summer

Strand 3: MODEL – Band 05B



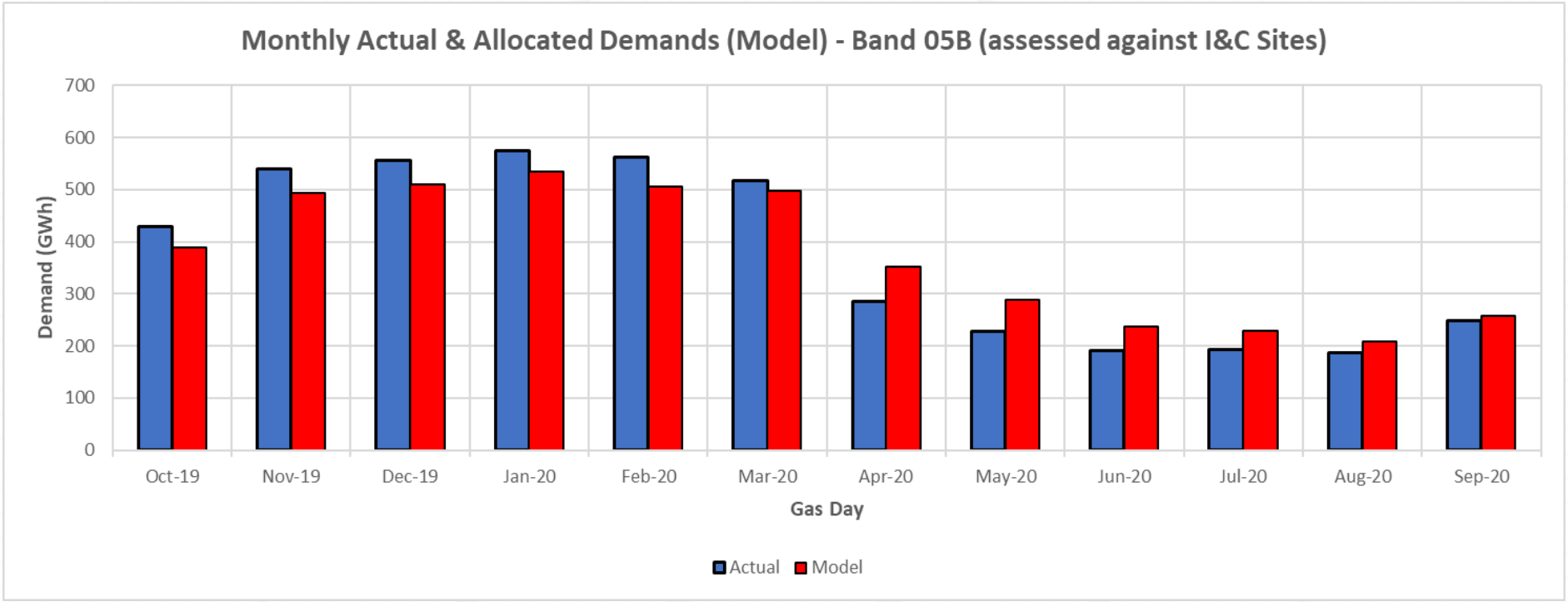
- Graph shows daily actual and allocated demand on Model basis for Winter (Band 05B; I&C sites)
- Pattern of under allocation throughout most of Winter period (potentially Sample AQ reflecting the pandemic influenced demand could mean it is low compared to genuine levels at the particular day/time of the year).
- The 23rd March 2020 signalled a period of over allocation, coinciding with the start of the National lockdown

Strand 3: MODEL – Band 05B



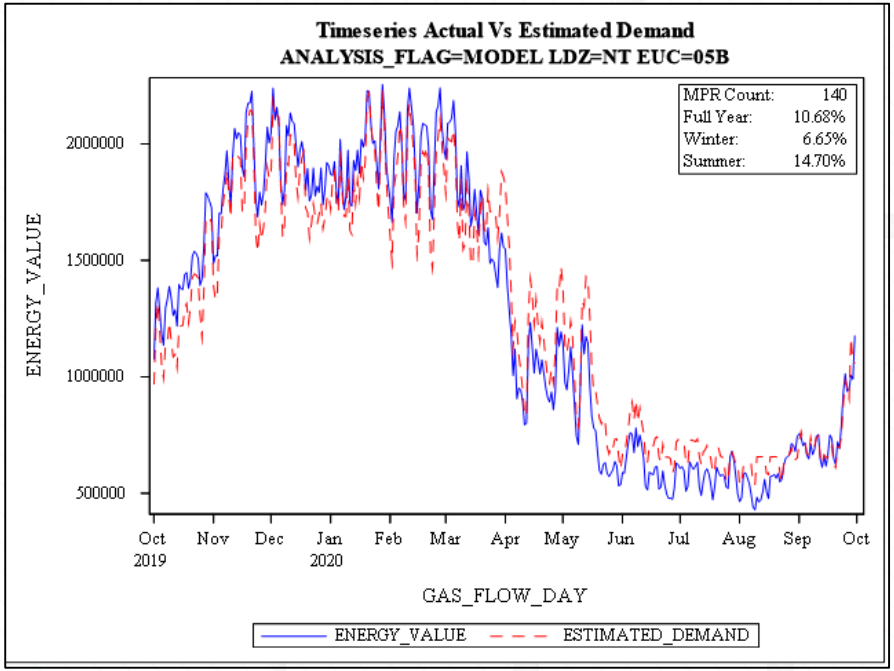
- This plot for the Summer period continues the trend of over allocation until the end of the period, although the extent of the over allocation diminished towards the end of August 2020.

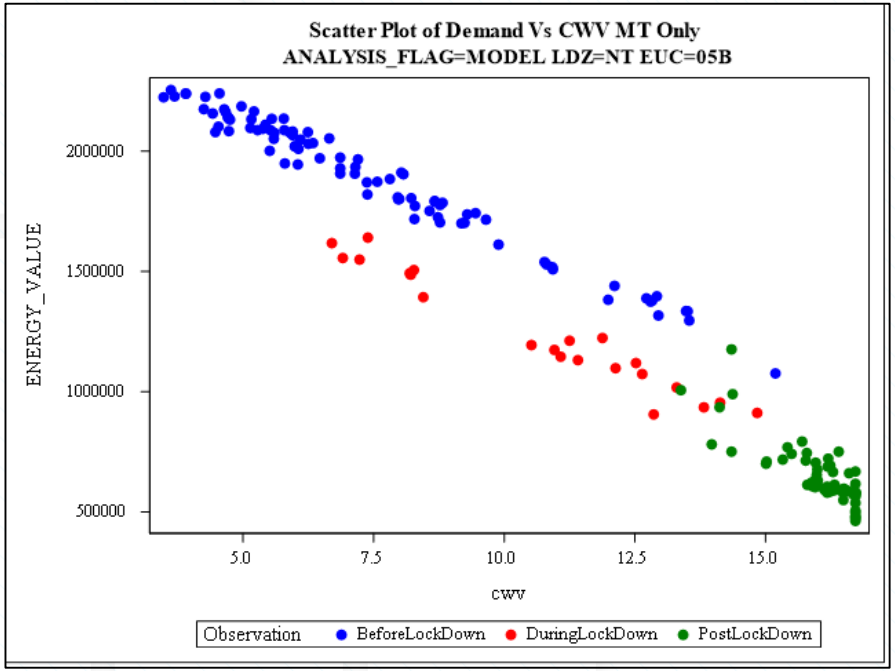
Strand 3: MODEL – Band 05B



- Chart shows aggregated monthly actual and allocated demand for Band 05B
- There is a clear under allocation in all winter months.
- In all summer months there has been an over allocation, reflecting the change in demand both during and after the lockdown with smaller differentials in August and September 2020.

Strand 3: MODEL – NT Band 05B





- NT LDZ for band 05B is characterised by under allocation in winter with an over allocation from April onwards.
- The scatter plot (Monday to Thursdays non holidays) shows graphically the materially different trend during and post the lockdown

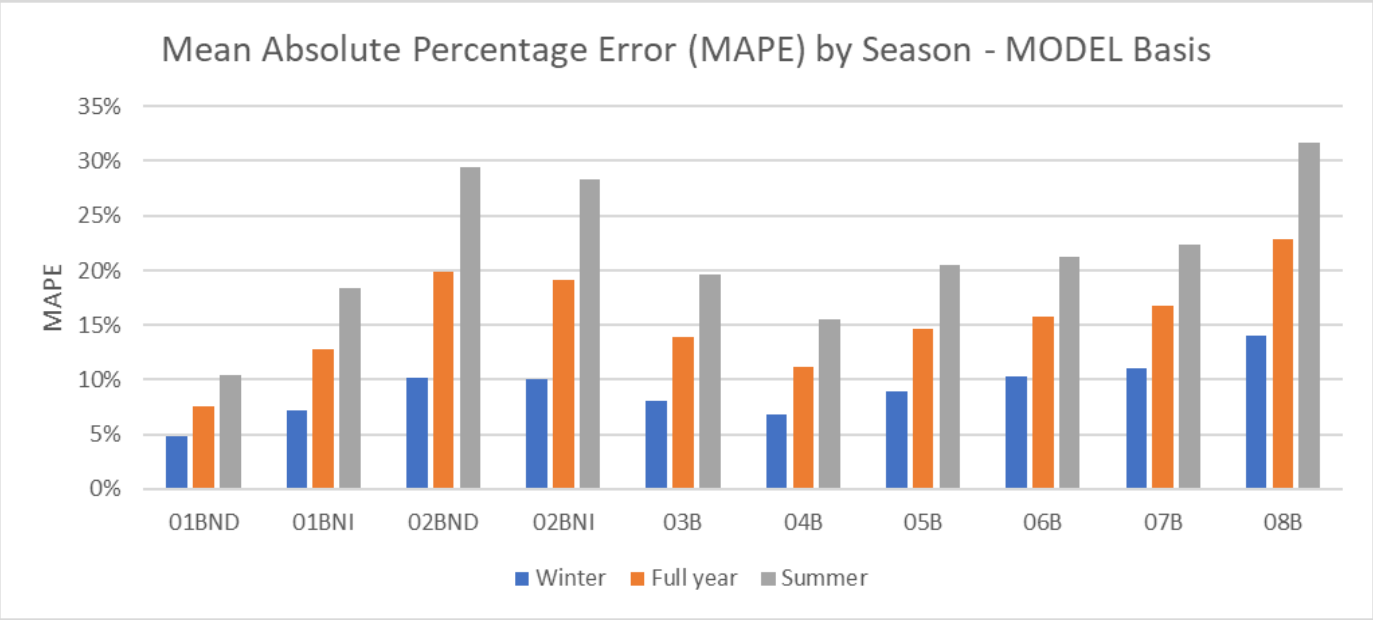
Strand 3: MAPE Analysis

- 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

- 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 – EUC Band Summary



- Chart shows simple summary of the overall error on the 'MODEL' basis
- Full Year MAPE values range from 7.6% (5.97% - 2019) to 22.8% (17.63% - 2019)
- Note: Actual summer demands are lower than winter demands and hence percentage errors can be somewhat greater in the summer. Summer demands have been further reduced by the Pandemic.

Strand 3: MODEL – Current vs Previous Year

Profiles	2018/19 Profiles		2019/20 Profiles		
Analysis	MODEL using 2018/19 Data		MODEL using 2019/20 Data		
EUC	Sample Count	MAPE (Full Year)	Sample Count	MAPE (Full Year)	vs Previous Year
01BND	2,450	9.03%	4,762	7.61%	-1.42%
01BNI	3,267	14.61%	3,215	12.81%	-1.80%
01BPD			0		
01BPI			0		
02BND	102	18.66%	121	19.81%	1.15%
02BNI	4,731	8.15%	5,592	19.17%	11.02%
02BPD			0		
02BPI			0		
03B	3,040	7.81%	3,073	13.89%	6.08%
04B	3,147	5.93%	3,225	11.17%	5.24%
05B	1,404	5.93%	1,338	14.67%	8.74%
06B	487	7.87%	462	15.75%	7.88%
07B	184	14.30%	147	16.72%	2.42%
08B	78	17.64%	64	22.83%	5.19%

- Table shows comparison of Full Year MAPE by EUC against the equivalent analysis from the previous year, where available, on the ‘MODEL’ basis
- Green denotes an improvement; Red denotes a worsening
- The majority of I&C EUCs show a worsening in allocation over the full year which is as expected given impacts of the pandemic

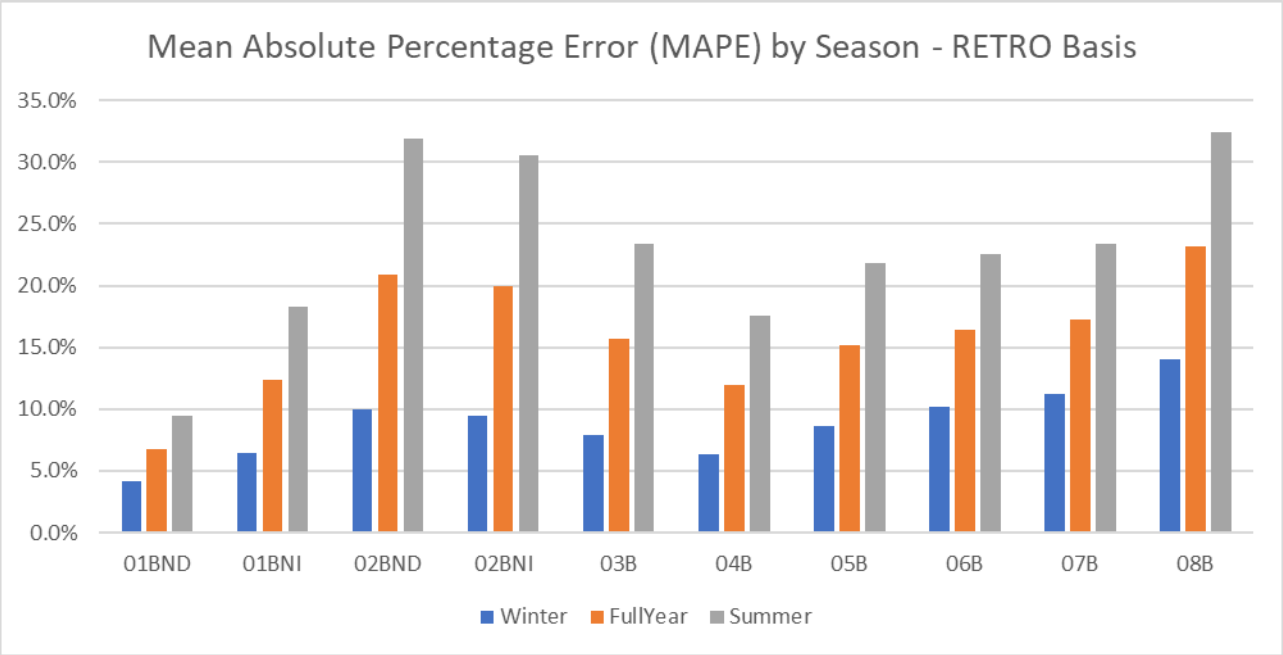
Strand 3: Retro Basis Analysis

- The ‘RETRO’ analysis is based on the algorithms derived for the current Gas Year (i.e. 2020/21) but retro fitted with appropriate adjustment for the pattern of days of the week and holidays for Gas Year 2019/20

- 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)

Strand 3: RETRO – EUC Band Summary



	MAPE Diff (Retro minus Model)		
EUC	Winter	FullYear	Summer
01BND	-0.7%	-0.8%	-1.0%
01BNI	-0.8%	-0.5%	-0.1%
02BND	-0.2%	1.1%	2.4%
02BNI	-0.5%	0.8%	2.2%
03B	-0.2%	1.8%	3.8%
04B	-0.4%	0.8%	2.0%
05B	-0.3%	0.6%	1.4%
06B	-0.1%	0.6%	1.3%
07B	0.1%	0.6%	1.1%
08B	0.0%	0.4%	0.8%

- Chart shows simple summary of the overall error on the ‘Retro’ basis
- Table shows MAPE difference compared to equivalent ‘Model’ assessment
- Full Year period errors are better in Band 1 with a worsening for all the remaining bands.
- Consistent with the trends being observed.
- Results for bands 01 & 02 susceptible to ‘Market Sector Code’ and prepayment mis-classification

Strand 3: Conclusions – Algorithm Accuracy

NDM Daily Demand Analysis suggests:

- The analysis this year has been inconclusive with :
  - Demand levels being heavily influenced by the COVID pandemic and subsequent national and local lockdowns
  - Calculation of sample AQ potentially causing some of the under allocation we are seeing in the winter months prior to the lockdowns
  - However the shape of the allocation to demands is reassuring albeit at a marginally different level for the reasons above
- The Retro model is suggesting that the new seasonal normal datasets that come into use from October 2020, are an improvement over the previous model in both NDM levels and UIG (from Strand 2).

Analysis of New EUC Profiles

- The introduction of the 01BNI EUC has shown it fits the demand pattern better than the traditional 01BND profile
- However, to fully utilise these new profiles, shippers must ensure the ‘Market Sector Flag’ held on UK Link is relevant for their portfolios

Strand 3: Conclusions – Modelling Approach

Modelling Approach for Gas Year 2021/22 (in Spring 2021):

- 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 2021