NDM Modelling Error

MOD 0781R – Distribution Workgroup
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Provided by:

1) What is NDM Modelling Error ?

LDZ Demand Attribution:	LDZ Measured	− DM Measured	− NDM Estimated	− Shr Estimated	= UIG Remaining

NDM Supply Meter Point Demand: $\sum$ EUC | AQ / 365 | $* \text{ALP}_t$ | $* 1 + \text{WCF}_t * \text{DAF}_t$

- NDM Modelling Error is the difference between the Estimated view of Demand at D+5 and the Actual demand for the NDM population (c.24m)

- The estimate of "NDM Supply Meter Point Demand" is derived by the "NDM Algorithm" which relies on Gas Demand Profiles built from underlying Demand Models for each End User Category (EUC)

- NDM Modelling Error causes 'Temporary UIG' at D+5 until Meter Point Reconciliation occurs in the NDM population. At this point the differences become known and the error is removed from UIG

2) What are the causes of NDM Modelling Error ?

NDM Supply Meter Point Demand:	$\sum$	Part A EUC	Part B AQ / 365	Part C * ALP_t	Part D * $1+WCF_t* DAF_t$

- EUC Demand Models aim to represent the NDM Population consumption behaviour as accurately as possible however, naturally with any model, imperfections will exist which cause Modelling Error

- These imperfections can be caused at various points within the NDM Algorithm, considered below:

Part A — The End User Category (EUC) is the means for splitting up the various consumer types within the NDM population. Inaccuracy of Supply Point data in UK Link e.g. Market Sector Code, can contribute towards causing modelling error – e.g. inappropriate EUC assignment and/or use in demand model production

Part B — The Annual Quantity (AQ) provides a view of typical annual consumption assuming seasonal normal conditions. Inaccuracy in the AQ in UK Link due to, for example, out of date meter readings, can contribute towards causing modelling error – e.g. inappropriate EUC assignment and/or leading to an estimate which doesn't reflect latest consumption levels

Part C — The Annual Load Profile (ALP) provides a 'baseline' estimate of the seasonal normal demand for a particular day in the gas year. The ALP takes into account gas consumption characteristics such as day of the week, time of year, holidays and seasonal normal weather. All these features, although modelled, will not work perfectly and so can contribute towards modelling error

Part D — The Weather Correction Factor (WCF) and Daily Adjustment Factor (DAF) adjust the seasonal normal demand to reflect the observed weather conditions on the day. The DAF reflects an EUC's weather sensitivity based on historical consumption, however, although modelled, will not work perfectly in combination with the ALP and so this final part of the NDM Algorithm can also contribute towards modelling error

3) How is NDM Modelling Error measured ?

- The industry as a whole clearly has a role to play in maintaining Supply Point data on UK Link and ensuring meter reads are upto date to support accurate AQs and EUC assignment, however the main demand modelling obligations reside with Demand Estimation Sub Committee (DESC)

- As the custodian of the process for (i) deriving End User Categories, (ii) Gas Demand Profiles (ALP,DAF) and (iii) maintaining the relationships between weather and demand through the Composite Weather Variable (CWV), it is important that DESC reviews the accuracy of the EUC demand modelling process

- Each December, DESC completes a review of the 'NDM Algorithm performance' for the previous Gas Year. This analysis currently considers three 'Strands': 1) Weather 2) UIG and 3) Modelling Error

- 'Strand 3 Modelling Error' is calculated by comparing daily actual consumption from a sample of consumers for each EUC and comparing this to the demand allocated via the NDM Algorithm, which can provide an indicator of the modelling error at population level

	Part A	Part B	Part C	Part D
NDM Supply Meter Point Demand: $\sum$	EUC	AQ / 365	$* ALP_t$	$* 1 + WCF_t * DAF_t$

- However, the Strand 3 analysis attempts to only consider the imperfections caused by Part C and D. Modelling Error caused by out of date AQs (i.e. Part B) is 'out of DESC's hands'.

- This analysis can be flawed if the supply point data is incorrect, leading to inappropriate conclusions. Part A of the NDM Algorithm is also partly considered when, for example reviewing the success (or not) of new EUCs

- In December 2021, DESC considered the latest analysis for Gas Year 2020/21, full summary results available here: Strand 3 Analysis . Example extracts shared on the next few slides and below:

Fig. 1: Domestic Band 1 EUC: Modelling Error based on sample of 3,579 MPRs
Generally, the "01BND" model tracks actual consumption pretty well over the Gas Year and in particular during high volume Winter months

Strand 3: MODEL − Band 01BND

MPE +ve = Under allocation
     −ve = Over allocation

Daily Actual & Allocated Demands (Model) - Band 01BND (assessed against Domestic Sites)

	MPE	MAPE	MPR Count
FullYear	-2.96%	8.04%	3579
Winter	-0.44%	5.11%	
Summer	-5.47%	10.95%	
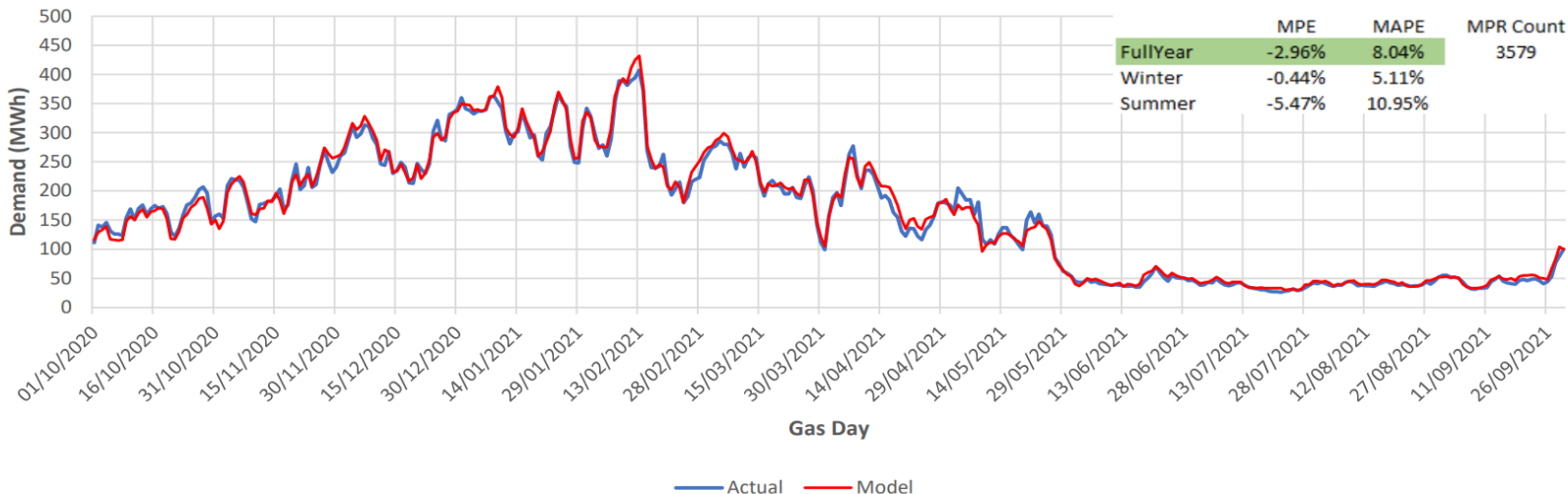
Fig. 2: Results for I&C EUC in Band 1 – sample of 5,149 MPRs
Chart on left shows profile using new I&C profile ("01BNI"). Chart on right shows profile using Domestic profile ("01BND").
Approx 500K Supply Points now benefitting from a clearly more suitable profile
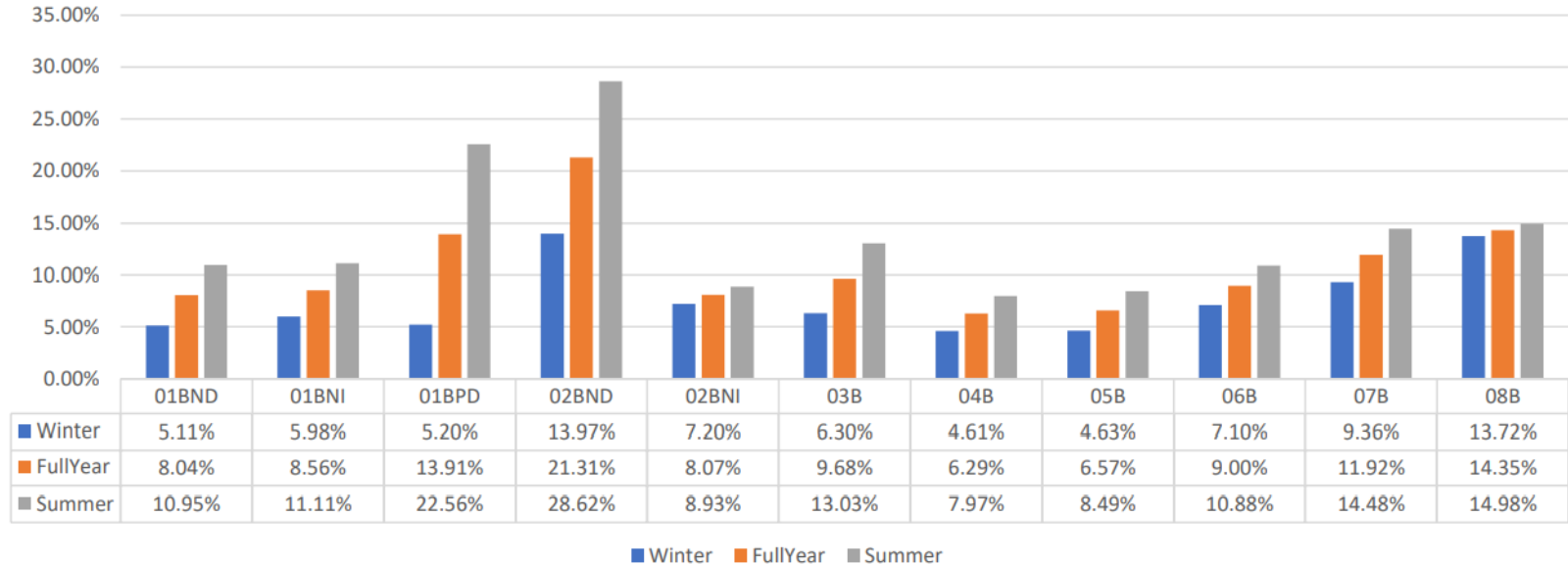
Strand 3: MODEL – Band 01BNI Tested against 01BND

Daily Actual & Allocated Demands (Model) - Band 01BNI (Winter - assessed against I&C Sites)

Daily Actual & Allocated Demands (Model) - Band 01BND (Winter - assessed against I&C Sites)
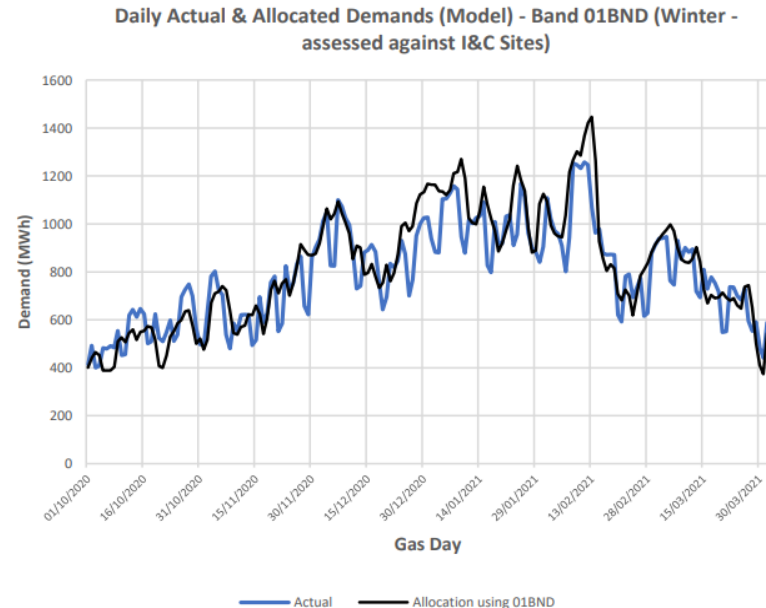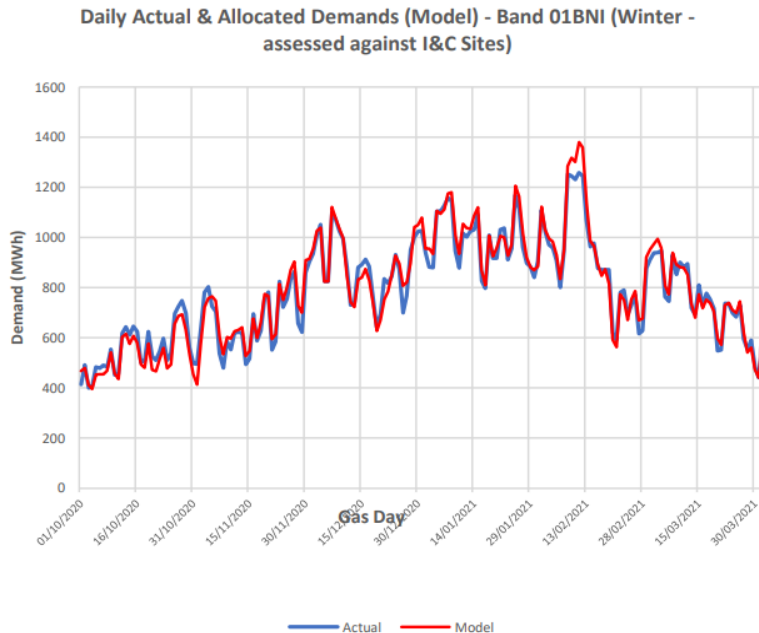
Fig. 3: Summarises Overall Modelling Error by EUC – note this is the MAPE i.e. absolute error
Band 2 Domestic ("02BND") Modelling Error results likely to be caused by incorrect Market Sector Codes
Band 1 Prepayment Domestic ("01BPD") uses a model that is nearly 10 years old, also more vulnerable to Supply Point data accuracy

Strand 3: MODEL – EUC Band Summary

Mean Absolute Percentage Error (MAPE) by Season - MODEL Basis

|	01BND	01BNI	01BPD	02BND	02BNI	03B	04B	05B	06B	07B	08B
Winter	5.11%	5.98%	5.20%	13.97%	7.20%	6.30%	4.61%	4.63%	7.10%	9.36%	13.72%
FullYear	8.04%	8.56%	13.91%	21.31%	8.07%	9.68%	6.29%	6.57%	9.00%	11.92%	14.35%
Summer	10.95%	11.11%	22.56%	28.62%	8.93%	13.03%	7.97%	8.49%	10.88%	14.48%	14.98%

■ Winter ■ FullYear ■ Summer

5) What is being done to improve NDM Modelling Error?

- The DESC workplan each year includes time put aside each Autumn/Winter to review areas of the Demand Modelling process which can be improved for the following year

- In recent years this time has been used to:
  - Review and derive improvements to the Composite Weather Variable (CWV) formula (e.g. addition of Solar Radiation term) and update the Seasonal Normal basis
  - Increase the number of EUCs within Bands 1 and 2 to provide more suitable profiles

- This year DESC is reviewing the current set of 'holiday code rules' which are used to determine how the Gas Demand Profiles used in the NDM Algorithm will 'flex' during regular holiday periods such as Christmas/New Year, Easter, May Bank Holiday etc

- All of the above are examples of seeking improvements in the levels of modelling error and thus reducing Reconciliation and Temporary UIG volumes

- In addition, UNC Workgroup 0754R, is looking at how the use of advanced analytics (e.g. machine learning) could be used to improve the accuracy of the NDM demand models working within the structure of the current NDM Algorithm (i.e. ALPs and DAFs)

6) When is NDM Modelling Error removed from UIG ?

- Following the issuing of the Reconciliation invoice each month an updated UIG chart (Fig.1) is provided which shows the "Allocated UIG" i.e. D+5 position versus the estimated "Latest % Post Reconciliation"

Fig. 1: D+5 UIG vs Post Rec UIG
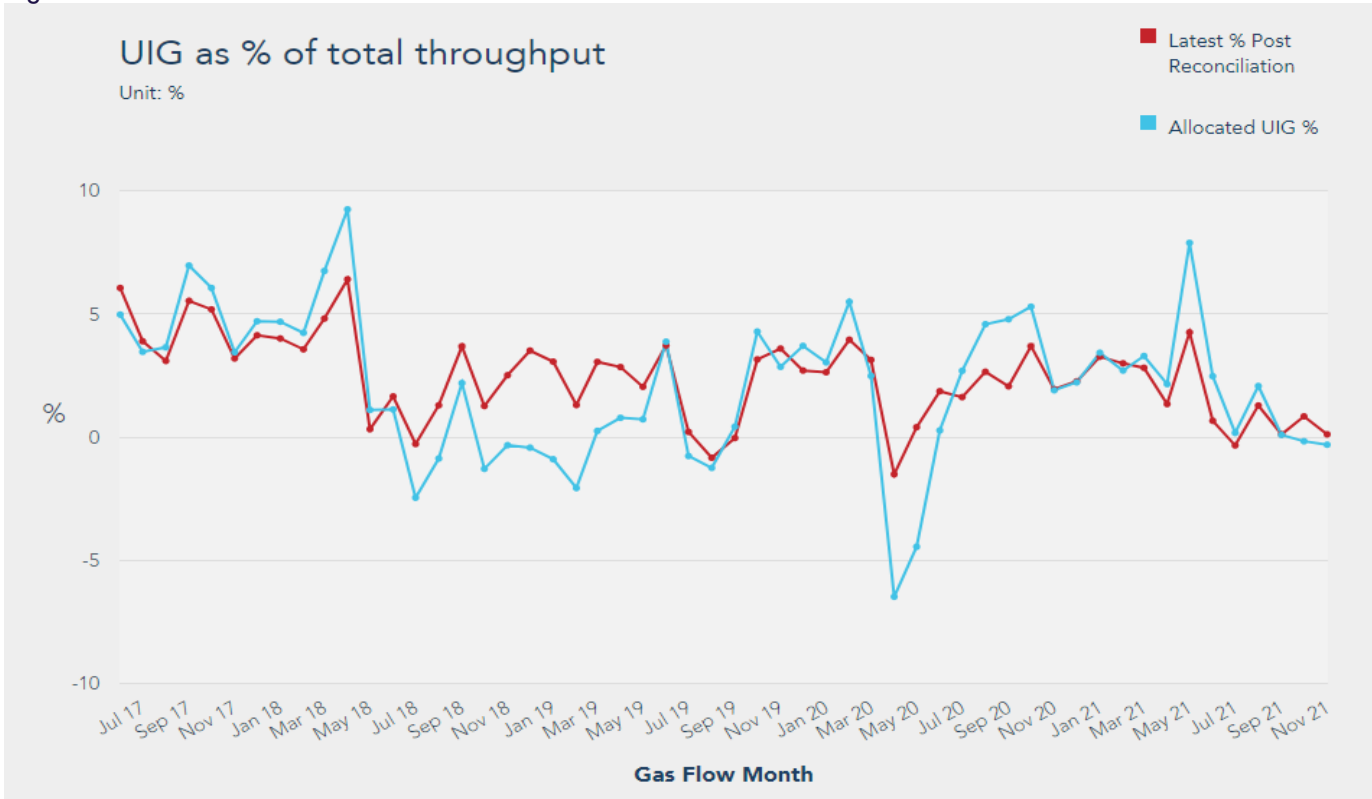
- The difference between the two lines represents the difference caused by all parts of the NDM Modelling Error plus any other items that go through reconciliation e.g. DM reconciliation.

- Note: This is not definitive as we do not know how the actual consumption between a pair of meter readings has been used on a daily basis