

Xoserve

# Modelling Approach 2020

Draft – For Review

Demand Estimation Team  
20<sup>th</sup> January 2020

**MODELLING APPROACH 2020 – DRAFT FOR REVIEW****EXECUTIVE SUMMARY****Context:**

Gas Demand Profiles represented as 3 parameters – (i) Annual Load Profile (ALP), (ii) Daily Adjustment Factor (DAF) and (iii) Peak Load Factor (PLF) support a number of key industry processes such as NDM Nominations/Allocations, AQ calculation and Capacity Invoicing.

Each gas year the approach to the development of the following year's Gas Demand Profiles (UNC Term – “Derived Factors”) is agreed with the Demand Estimation Sub Committee (DESC) and described in a document referred to as the “Modelling Approach”. The review and agreement of the Modelling Approach normally takes place around February each year for the following Gas Year. It represents an important milestone which, when achieved, triggers the commencement of the Gas Demand EUC Modelling process.

The Gas Demand EUC Modelling performed in 2020 will drive the new set of industry parameters required for the Gas Year commencing 1<sup>st</sup> October 2020. Appendix 1 provides a visual representation of the Gas Demand EUC Modelling lifecycle and where this document fits within it.

**Questions:**

The document will provide answers to the following areas

**Daily Gas Consumption Data:**

This section covers which years and months of Daily Gas Consumption Data will be used in the modelling analysis, the sources of this data and how the data will be validated and selected.

**Daily Weather Data:**

This section covers which weather stations and versions of Composite Weather Variables (CWV) and Seasonal Normal weather (SNCWV) will be used in the modelling analysis.

**End User Categories (EUC):**

This section describes which types of consumers shall be grouped together from the Daily Gas Consumption Data for Gas Demand EUC Modelling.

**Gas Demand EUC Modelling:**

This section explains the detailed rules applied to the regression analysis which form the basis of the Gas Demand EUC Modelling process.

**Demand Model Smoothing:**

This section explains how ‘smoothing’ will be applied to the models for the coming gas year, which effectively averages the impacts of the previous [3] years modelling process in order to provide a more stable set of models.

**Gas Demand Profiles:**

This section describes the key output from the Demand Model Smoothing process and the values which will be subject to industry consultation and approval ahead of loading them into Xserve systems.

**NDM Algorithms Booklet:**

This section explains how all of the information, results and decisions made during the end to end process is summarised and provided to the industry.

**Industry Consultation:**

This section provides a summary of the key checkpoints in the process and how and when DESC and/or any sub-group of DESC members will be involved in the decision-making process.

**Conclusions:**

This year's document is effectively the same as last years in terms of the principles for how the Gas Demand EUC Modelling shall be carried out. The main differences are:

- i) The version of weather to be used following DESC's recent decision to agree new values of CWV and SNCWV
- ii) The system that will be used by the Demand Estimation team to execute the Gas Demand EUC Modelling and the subsequent material that will be provided to DESC to review
- iii) Changes to the layout and sequence of the document to hopefully provide a more logical flow.

**Input Sought:**

DESC and Technical Workgroup Representatives are asked to review the document and raise any questions ahead of a DESC meeting on 10<sup>th</sup> February 2020 where formal approval will be sought from DESC members.

**DAILY GAS CONSUMPTION DATA:**

Daily Gas Consumption Data is a critical input to the production of Gas Demand Profiles. This data is collected by sampling the NDM population.

The latest modelling analysis year requires Daily Gas Consumption Data for the period 1<sup>st</sup> April 2019 to 31<sup>st</sup> March 2020.

This 12-month period includes at least one complete Easter holiday weekend in the data sets for that year.

**Sources:**

The expected source of the majority of the Daily Gas Consumption Data is from sampling managed by Xoserve and the Distribution Networks. The Xoserve sampling is mainly comprised of EUC Band 1 domestic sites. It also includes some EUC Band 1 non-domestic sites and EUC Band 2 sites (non-domestic and domestic). The Distribution Network sampling typically covers EUC Band 2 and above (up to and including EUC Band 9).

Due to declining numbers in both of these sampling portfolios, at its meeting on 17th November 2015 DESC agreed the use of third-party provided Daily Gas Consumption Data in the Gas Demand EUC Modelling process, which has previously been provided on a voluntary basis.

From 1<sup>st</sup> March 2019 the implementation of Modification 0654S introduced an obligation into the UNC for the provision of regular Daily Gas Consumption Data from Shippers (with a portfolio >25K) to the Central Data Service Provider (CDSP).

Any data provided by a third party will be required in an agreed format (file format document available on DESC's homepage on the Joint Office website) and be subjected to the same validation rules applied to the Xoserve and Distribution Network sampling.

Following DESC's decision in 2019 to introduce new EUCs in Bands 1 and 2 it will be necessary to collect additional Daily Gas Consumption Data for Gas Demand Profiles which represent i) meter points in Band 1 (0-73.2 MWh pa) which are categorised as non-domestic, ii) meter points in Band 1 which use pre-payment meters and iii) meter points in Band 2 (73.2-293 MWh pa) which are categorised as domestic. There are a low number of prepayment customers in Band 2 at a national level and creating a Gas Demand Profile for this customer group is reliant on data being provided by third parties. Previous Daily Gas Consumption Data collections have been insufficient to derive a Gas Demand Profile and DESC will be provided with options if this year's collection is not sufficient.

**Validation and Selection:**

The Daily Gas Consumption Data collected for the period 1<sup>st</sup> April 2019 to 31<sup>st</sup> March 2020 will be subject to validation prior to its use in Gas Demand EUC Modelling. The validation criteria aims to strike the balance between maximising the amount of Daily Gas Consumption Data available for modelling and ensuring any erroneous and/or missing data is removed from the process, so as not to have an adverse effect on the modelling results and conclusions.

Appendix 2 displays a summary of the validation criteria to be applied to the various EUC Bands.

Due to different weather sensitivities for small domestic users, DESC agreed at its meeting on 10<sup>th</sup> December 2018 that it would be good practice if the validated Daily Gas Consumption Data selected for the Band 1 domestic model are sourced appropriately from different sub bands. DESC also recommended applying a stratification method to Band 2 Non-Domestic sites.

This approach will continue this year with the following stratification applied:

Band 1 Domestic: Sub bands: 0-10, 10-20, 20-30 30-73.2 MWh.

Band 2 Non-Domestic: Sub bands: 73.2-140, 140-210, 210-293 MWh.

Where the validated Daily Gas Consumption Data for a particular EUC Band are well in excess of the ideal target numbers, DESC agreed at its meeting on 10<sup>th</sup> December 2018 that a process should be created to select the required amount of data needed to be representative of the population. In this case, this means not using all of the available data. DESC agreed that the Xoserve and Distribution Network sampling should be used primarily to retain continuity within the Gas Demand EUC Models. Any additional data obtained from third parties will be randomly selected to avoid any shipper bias in the resulting Gas Demand Profiles.

Appendix 3 displays the latest view of the ideal sampling size for post-validation Daily Gas Consumption Data. These numbers are based on a snapshot of the population as of January 2020.

All validated Daily Gas Consumption Data shall be aggregated prior to its use in the Gas Demand Modelling System.

**DAILY WEATHER DATA:**

Daily Weather Data is a critical input to the production of Gas Demand EUC Models.

The latest Gas Demand EUC Modelling analysis year requires daily weather data for the period 1<sup>st</sup> April 2019 to 31<sup>st</sup> March 2020.

The weather variables used in Gas Demand EUC Modelling in spring 2020 will be Composite Weather Variables (CWVs) and Seasonal Normal Composite Weather Variables (SNCWVs).

The CWVs used will reflect the new formula approved by DESC at its meeting on 7<sup>th</sup> October 2019 and the SNCWVs used will be those approved by DESC at its meeting on 9<sup>th</sup> December 2019. Both of these are due to become effective from 1<sup>st</sup> October 2020 which is why they need to be used in the Gas Demand EUC Modelling process in Spring 2020.

**Yeovilton Weather Station:**

At its meeting on 5<sup>th</sup> September 2018, DESC discussed the closure of Filton weather station. Analysis of a suitable substitute station was presented and DESC agreed on Yeovilton being the preferred station. From 1<sup>st</sup> October 2018 the CWV for LDZ SW has been using the weather data from Yeovilton with bias adjustments applied to mimic Filton. The bias adjusted CWV for SW will be applied up until 30<sup>th</sup> September 2020 in the daily calculation of CWV in Xserve systems, however in the 2020 modelling the CWVs for SW LDZ will be using pure Yeovilton weather data, this is possible now we have optimised parameters derived directly from Yeovilton weather station.

There are no expected changes for the remaining weather stations ahead of the start of gas year 2020/21.

**Weather Stations:**

List of weather stations expected to be used for Gas Demand EUC Modelling in 2020:

LDZ	Temperature	Windspeed	Solar Radiation
EA	London Heathrow	London Heathrow	London Heathrow
EM	Nottingham Watnall	Nottingham Watnall	Nottingham Watnall
NE	Nottingham Watnall	Nottingham Watnall	Nottingham Watnall
NO	Albemarle Barracks	Albemarle Barracks	Durham Weather Station
NT	London Heathrow	London Heathrow	London Heathrow
NW	Rostherne No 2	Rostherne No 2	Rostherne No 2
SC	Glasgow Bishopton	Glasgow Bishopton	Glasgow Bishopton
SE	London Heathrow	London Heathrow	London Heathrow
SO	Southampton Oceanographic Institute	Southampton Oceanographic Institute	Southampton Oceanographic Institute
SW	Yeovilton Weather Station	Yeovilton Weather Station	Yeovilton Weather Station
WM	Birmingham Winterbourne 2	Coleshill	Coleshill
WN	Rostherne No 2	Rostherne No 2	Rostherne No 2
WS	St. Athan	St. Athan	St. Athan

**END USER CATEGORIES:**

End User Categories represent different groups of gas consumer types and also represents a critical input to the production of Gas Demand EUC Models. The proposed EUC groupings need to be defined ahead of the Gas Demand EUC Modelling process.

**Proposed EUCs for Gas Year 2020/21 – Bands 1 and 2**

The proposed End User Categories for Gas Year 2020/21 for EUC Bands 1 and 2 are displayed in the table below:

Consumption Range (Kwh pa)		EUC Description	Consumer Type	No. of Models Required
From	To			
0	73,200	xx:Eyy01BND	Domestic	1
0	73,200	xx:Eyy01BPD	Prepayment Domestic	1
0	73200	xx:Eyy01BNI	I&C	1
0	73,200	xx:Eyy01BPI	Prepayment I&C	1*
73,201	293,000	xx:Eyy02BND	Domestic	1
73,201	293,000	xx:Eyy02BPD	Prepayment Domestic	1*
73201	293000	xx:Eyy02BNI	I&C	1
73,201	293,000	xx:Eyy02BPI	Prepayment I&C	1*

\*Note: It is likely that insufficient Daily Gas Consumption Data will be available (due to low population numbers) for some of these proposed EUCs. At its meeting on December 10<sup>th</sup> 2018, DESC confirmed the following principle for the proposed EUCs which are most likely to be affected by insufficient data:

For the Prepayment I&C EUCs (xx:Eyy01BPI and xx:Eyy02BPI) the underlying Gas Demand EUC Models can utilise the Non-Prepayment I&C model in the equivalent EUC Band (xx:Eyy01BNI and xx:Eyy02BNI respectively).

For the Prepayment Domestic EUCs in Band 2 (xx:Eyy02BPD) the underlying Gas Demand EUC Models can utilise the Prepayment Domestic EUC in Band 1 (xx:Eyy01BPD).

**Proposed EUCs for Gas Year 2020/21 – Bands 3 and above**

The proposed End User Categories for Gas Year 2020/21 for EUC Bands 3 and above are displayed in the table below:

Consumption Range (Kwh pa)		EUC Description					No. of Models Required
From	To	Bucket Band	WAR Band1	WAR Band 2	WAR Band 3	WAR Band 4	
293,001	732,000	xx:Eyy03B	xx:Eyy03W01	xx:Eyy03W02	xx:Eyy03W03	xx:Eyy03W04	5
732,001	2,196,000	xx:Eyy04B	xx:Eyy04W01	xx:Eyy04W02	xx:Eyy04W03	xx:Eyy04W04	5
2,196,001	5,860,000	xx:Eyy05B	xx:Eyy05W01	xx:Eyy05W02	xx:Eyy05W03	xx:Eyy05W04	5
5,860,001	14,650,000	xx:Eyy06B	xx:Eyy06W01	xx:Eyy06W02	xx:Eyy06W03	xx:Eyy06W04	5
14,650,001	29,300,000	xx:Eyy07B	xx:Eyy07W01	xx:Eyy07W02	xx:Eyy07W03	xx:Eyy07W04	5
29,300,001	58,600,000	xx:Eyy08B	xx:Eyy08W01	xx:Eyy08W02	xx:Eyy08W03	xx:Eyy08W04	5
58,600,001		xx:Eyy09B					1

In line with the Modelling Approach for 2019, the analysis of the Daily Gas Consumption Data will focus on confirming the most appropriate levels of aggregation to apply to the data sets for the various EUC analyses within the existing EUC boundaries. In line with previous practice, WAR band EUCs over the consumption range 293-2196 MWh pa will be based on the overall range, which should then enable analysis by individual LDZ instead of LDZ groupings.

**Exploratory Analyses**

During 2013 DESC asked TWG to investigate the boundaries of the current EUC definitions and assess whether any more appropriate NDM groupings exist. Results of this analysis were shared at the TWG meeting on 27<sup>th</sup> November 2013 and the TWG meeting on 15<sup>th</sup> January 2014. It was agreed that there did not appear to be any obvious 'new bandings' emerging, however TWG did make a recommendation to DESC to merge bands 07 (14650 – 29300 MWh pa) and 08 (29300 – 58600 MWh p.a.) for Gas Demand EUC Modelling purposes only, owing to the similarity in their profiles. DESC had already previously agreed that should it become necessary due to insufficient Daily Gas Consumption Data, the sampling applicable to consumption bands 07 and 08 could be combined for WAR band Gas Demand EUC Modelling in these consumption ranges. At its meeting on 13<sup>th</sup> February 2018 DESC agreed to retain the existing EUC definitions in terms of AQ ranges, however it was agreed that an updated review of the boundaries which define the EUCs for the Large NDM population should be added to DESC's ad hoc work plan.

**GAS DEMAND EUC MODELLING:**

This section provides a broad outline of the proposed modelling approach to be adopted for the 2020 analysis which, in the main, will be the same as applied in 2019.

Note: The main difference in 2020 will be the use of a new Gas Demand Modelling System to execute the modelling approach set out below and calculation of key parameters. The new system is more efficient and provides more flexibility.

**Modelling Approach:**

1. This approach is detailed in the flowcharts shown in Appendix 4 (which is also explained on pages 9 and 10 in Section 3 of the June 2019 NDM Algorithms booklet).  
  
A broad outline of the approach is reproduced below:
  - a. Exclude warm weather data and summer data (i.e. June to September) and fit a line to the remaining data. Any flat Gas Demand EUC Models are detected and re-run with all the data.
  - b. Warm weather data (for exclusion) is defined in this context as the warmest 2° of data (i.e. that for which the CWV is greater than Max. CWV - 2°).
  - c. 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.
  - d. 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). Fit a line to the augmented data set, excluding the warmest 2°, to establish whether a cut-off is appropriate, considering potential cut-offs in the range 0.5 to 4 degrees below the maximum value of the composite weather variable. The criterion applied from spring 2001 onwards, of a 20% improvement in the mean square residual over that obtained by using the straight line alone, will be retained in assessing whether or not there should be a cut-off applied to each individual year model.
  - e. If a cut-off is not required, then reintroduce the warmest 2° of data and fit a line to the entire data set.
  - f. Demand Model Smoothing considers three years' models and the application of summer reductions or not to the smoothed model is dependent on all of the years contributing to the smoothed model. Thus it is possible that the smoothed model will not incorporate a summer reduction, in spite of a summer reduction being identified for one (or more) of the individual years. To cover this eventuality, it is necessary in each year's modelling to produce models with and without summer reductions. The model without summer reductions will be produced by including summer data (except for the warmest 2°) in the regression in step a above, and fitting a cut-off if necessary, as in steps d and e above.
2. As previously agreed and implemented from the spring 2002 NDM analysis onwards, weekend effects for the "01B" EUCs will be modelled using the same "variable weather sensitivity" form of model used for all other EUCs. (This form of the model is set out in Section 3 of the June 2019 NDM Algorithms booklet.). Note: This approach will also be applied to the new EUCs in Bands 1 and 2.
3. The Daily Gas Consumption Data applicable to the analysis year 2019/20 will not have been analysed previously, and so, investigation of the most appropriate data aggregations, determination of WAR band limits, etc., will be undertaken with respect to this data set. This will be done in conjunction with the Technical Work Group (a decision point described in the Industry Consultation section of this document).
4. The Gas Demand EUC 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 for the spring 2020 analysis. This approach was agreed by DESC in December 2003, with a view to mitigating instability during the summer and was also applied to all previous NDM analyses from spring 2004 onwards.
5. In any single LDZ, the same definition of CWV will be used for all runs (i.e. for all EUCs in that LDZ and for all years of data).
6. Weekend, holiday and summer reductions will be calculated (where appropriate) as the average of the percentage reductions estimated for the three individual years' models; where applicable the CWV cut-off (at which models cease to be weather sensitive) will be the simple average of the three separate estimates. If for one or two of the three years there is no CWV cut-off, the maximum value of the CWV will be substituted as the cut-off for those years. Further details are provided in the attached Appendix 6.

The holiday codes that apply to the Christmas/New Year period are the latest that were agreed following discussion at DESC on 8th November 2011. There are no planned special bank holidays at present for the 2020/21 period.

Therefore, the holiday code rules that apply will be unchanged from the 2019 analysis. Appendix 5 provides a summary of the holiday code rules which are applied in the Gas Demand Modelling System.

The set of holiday days applied to the analyses will be the union of the holidays applying to England and Wales on the one hand and Scotland on the other. This approach has been used since the adoption of Demand Model Smoothing in 1999 and continues to be appropriate because Daily Gas Consumption Data from geographically adjacent LDZs are usually aggregated to allow some EUCs to be modelled. Both population and sampling disposition are such that this aggregation of data is essential to enable modelling of all EUCs in all LDZs. No judgemental alterations will be made to the disposition or derived values of the ensuing holiday codes when they are applied to deriving Gas Demand Profiles for the target gas year (2020/21).

Following evidence presented at the 15<sup>th</sup> February 2017 DESC meeting which reviewed the performance of the "01B" EUC models during the summer months, a decision was made to exclude holidays from the regression models for "01B" EUCs, which now brings them in line with the practice used for all other EUCs.

Note: This approach will also be applied to the additional EUCs in Bands 1 and 2.

7. As set out in Appendix 6, the key aspect of averaging the models will be to average the ratio of the slope to the constant term, from each year's model. These ratios are equivalent to the reciprocals of the CWV intercepts.
8. Prior to the averaging, any Gas Demand EUC Models giving non-negative slopes on initial analysis (excluding the warmest weather from the regression), will be re-fitted to the entire data set. Any positive slopes remaining will be set to zero. This has become established practice.
9. The following approach will be taken in spring 2020 with respect to non-statistically significant (at the 95% confidence level) weekend effects:

For those EUCs where the Gas Demand EUC Models is based on domestic consumers (xx:Eyy01BND, xx:Eyy01BPD and xx:Eyy02BND) all positive non-significant weekend effects will be retained at their original values.

For all of the remaining EUCs, all negative non-significant weekend effects will be retained at their original values.

10. For large NDM (i.e. above 2196 MWh pa), the consumption band break points by which large NDM EUCs are defined will remain in line with current practice. However, it is intended following the DESC decision on 12th February 2014 that the Daily Gas Consumption Data applicable to the Gas Demand EUC Models for consumption ranges 14650 - 29300 MWh pa and 29300 - 58600 MWh pa (EUC bands 07 and 08, respectively) will be combined. This will provide better sampling numbers for more robust Gas Demand EUC Modelling and merge two bands which analysis has shown to display similar consumption behaviour.

It is recommended that the Daily Gas Consumption Data will be combined in this way for the consumption band EUCs and the WAR band EUCs. Even when data is combined in this way, separate EUCs will be defined for consumption band and WAR band EUCs in the consumption ranges 14650 - 29300 MWh pa and 29300 - 58600 MWh pa. This year the aggregations for the underlying Gas Demand EUC Models, used for deriving the final smoothed model for EUC bands 07 and 08, will all be based on the combined approach.

#### Reporting:

The output from this process is provided at the May DESC's Technical Workgroup meeting. It is anticipated that improved and more insightful modelling results and charts will be provided as a result of the new modelling being used in 2020.

Results of the Gas Demand EUC Modelling process will be provided as usual in the NDM Algorithms Booklet (Sections 4 and 5).

**DEMAND MODEL SMOOTHING:**

This section provides a broad outline of the proposed overall approach to Demand Model Smoothing for the 2020 analysis, which in the main will be the same as that applied in 2019.

**Demand Model Smoothing Approach:**

1. Year on year Demand Model Smoothing will be used in the 2020 analysis, in deriving the NDM Derived Factors to be applied to gas year 2020/21.
2. In the absence of evidence of trends in the parameters of the year on year Gas Demand EUC Models, simple averaging will be applied to the models feeding into Demand Model Smoothing.
3. The Gas Demand EUC Models for three years will be used for Demand Model Smoothing. The three years will be 2017/18, 2018/19 and 2019/20. For the second of these three analysis years, 2018/19, the data sets cover a thirteen month period (March to March); this is necessary to ensure that there is at least one complete Easter holiday weekend in the data sets for that year. For the first and third analysis year, 2017/18 and 2019/20, the data sets cover a twelve month period (April to March).

Note: For the relatively new EUCs in Bands 1 and 2 which require new data streams it is possible that the required historic Daily Gas Consumption Data will be unavailable to create 3 years of models, in which case Demand Model Smoothing will be limited to the number of years models available. Any subsequent references to model smoothing in this document and the use of 3 years will have the same rationale applied.

4. In applying smoothing, models from equivalent WAR bands in the three separate years will be averaged although WAR band limits change from year to year. This is the approach adopted for each NDM analysis since spring 1999 (i.e. all previous NDM analyses in which model smoothing was applied), and there is no real alternative to this. As a subsidiary point there is also a strong stability incentive to retain the current period (December to March) in the definition of the WAR values and therefore the existing definition will be retained for the 2020 analysis.
5. The approach to Demand Model Smoothing will be at the level of the underlying demand models, as was the case in the previous analyses. Further details are attached in Appendix 6 to this note.
6. Following the Autumn 2018 review, the assessment of the approach to Demand Model Smoothing is scheduled to be reviewed in full again by DESC during the autumn of 2020 following finalisation of the NDM algorithms for 2020/21.

**Models for Historical Years:**

1. To assist in any investigation of trends, all three years (i.e. 2016/17, 2017/18 and 2018/19) used in the 2019 implementation of model smoothing will be re-run to correctly take into account any changes in holiday periods applicable to the 2020 analysis.  
  
Note: For the additional EUCs, in the event that Daily Gas Consumption Data for these years is not available, model re-runs will be limited to the number of years available, possibly none.
2. Only the re-runs from the 2017/18 and 2018/19 Daily Gas Consumption Data will be used (along with the Daily Gas Consumption Data for 2019/20) in Demand Model Smoothing, making up the three years of data applied in the 2020 analysis.
3. For all EUCs the Daily Gas Consumption Data will cover the 12 month period April to March in 2017/18 and 2019/20 and cover the 13 month period March to March in 2018/19. All these contain at least one Easter holiday weekend.
4. The principles set out above for the Gas Demand EUC Modelling will also be applied to the historical years.

**Reporting:**

The parameters for the smoothed models will be provided in electronic form for each of the three years feeding into Demand Model Smoothing. For all final smoothed EUC models, information (i.e. values of factors and flags where these apply to each model) pertaining to: summer cut-off, summer reduction, non-holiday weekend effects, and holiday effects will be provided in electronic form. All CWV intercepts (for each year's models and for the smoothed model) will be provided in electronic form.

**Demand Model Smoothing Assessment:**

The last assessment of Demand Model Smoothing as applied to NDM demand estimation was presented at the DESC meeting on 8th October 2018. The results of the assessment confirmed that the objective of Demand Model Smoothing to reduce year on year volatility in the EUC models was being achieved. DESC supported Xoserve's recommendation to continue with the application of 3 year Demand Model Smoothing in the manner currently applied. DESC also agreed that the next review of the application of Demand Model Smoothing should take place in autumn 2020.



**GAS DEMAND PROFILES:**

“Derived Factors” is the UNC Section H Term to represent the Gas Demand Profiles which represent the three key output parameters from the Demand Estimation process.

These three parameters are:

- the Annual Load Profile (ALP) – represents the daily consumption profile for an EUC
- the Daily Adjustment Factor (DAF) – represents the daily weather sensitivity of demand for an EUC
- the Peak Load Factor (PLF) – a factor used to determine the peak load of a supply point within an EUC

**Derived Factors:**

The Demand Estimation Methodology document provides the formula for each of the parameters above, with further clarification provided below on how the parameters are derived.

1. The DAFs for gas year 2020/21 will be based on the formula in the Demand Estimation Methodology document. It is no longer required to be computed using output from an aggregate NDM demand model following the decision to change the Supply Meter Point Demand Formula.
2. In calculating DAF values in the case where the smoothed model has a cut-off, the reduction in the magnitude of weather sensitivity will be phased in as described in Section 9 on page 2 of the June 2019 NDM Algorithms booklet. This approach has been in place since its introduction at the time of the spring 1997 NDM analysis.
3. Peak Load Factor computations for each EUC will be based on the relevant smoothed model.

One of the key components of the EUC peak load factor is the estimate of the 1 in 20 Peak Day Demand (PDD). Prior to the implementation of UNC Modification 0331 the formula for calculating the Peak Load Factors was defined in specific detail in Section H of the UNC, including exactly how the PDD should be calculated (with different approaches for the Small and Large NDM sector), however it now states that “*the relevant sub-committee will determine the 1 in 20 peak day demand*”. The Demand Estimation Methodology, the supporting document which came into effect following the implementation of UNC Modification 0432 on 1st June 2017, makes no distinction between Small and Large NDM and simply states that “*the PDD will be determined by simulation using a long period of actual historic CWV data for the relevant LDZ*”.

Therefore the proposed approach for both Small and Large NDM uses simulation using the smoothed EUC demand model in conjunction with the database of historic daily composite weather variable values for the appropriate LDZ. This is in line with DESC’s decision in February 2016 to approve this approach.

4. In the context of the non-application of cut-offs to Gas Demand EUC Models in consumption range 0-293 MWh pa, and as agreed by DESC in December 2003, the values of ALPs for EUCs in this consumption range will be constrained to be never less than 1% of their maximum values. Note that this is a safeguard against a theoretical possibility of negative ALPs arising (in the profiles computed for all gas years since 2004/05 it has never been necessary to invoke this constraint).

**Reporting:**

Section 10 of the NDM Algorithms booklet customarily contains a comparison of the proposed EUC Peak Load Factors with the corresponding EUC Peak Load Factors that applied in the previous gas year (in this instance 2019/20). The same approach will be adopted in the 2020 NDM Algorithms booklet.

**ALP and DAF Factors:**

During the development of the ALPs and DAFs for Gas Year 2019/20, DESC approved an amendment to the Demand Estimation Methodology (3.5.3). This update proposed that the DAFs produced by the Demand Estimation process should be multiplied by a set of factors for use in the daily Gas Nominations and Allocations calculations.

These factors were developed by a member of the Demand Estimation Sub Committee and were designed to minimise the volatility of unidentified gas. In the event that DESC would like the option to utilise such factors again in 2020/21 this would require a set of factors to be calculated and agreed by DESC as well as a change to the Demand Estimation Methodology (3.5.3) which currently states the factors will be in place for Gas Year 2019/20 only.

Note: A decision to proceed with such factors should be considered alongside any recommendations from the UIG Workgroup which may mitigate the need for the approach taken in 2019.

**NDM ALGORITHMS BOOKLET:**

The outcomes of the annual Gas Demand EUC Modelling process are summarised each year in the NDM Algorithms booklet which is usually published at similar time as the proposed algorithm values.

The booklet will include a number of sections and will summarise key decisions and outcomes, such as:

- a) Numbers of validated data points used in the Gas Demand EUC Modelling
- b) EUC definitions
- c) Data aggregations used in the Gas Demand EUC Modelling (e.g. where data has been aggregated across multiple LDZs and/or consumption bands)
- d) WAR Band boundaries to be applied for the coming year
- e) Outcomes of the Gas Demand EUC Modelling, including regressions parameters and load factors
- f) A review of the performance of the NDM algorithm during the previous full gas year\* - 1) Weather Analysis, 2) Unidentified Gas Analysis and 3) NDM Daily Demand Analysis

**INDUSTRY CONSULTATION:**

The consultation process on the proposed Gas Demand Profiles takes place during June and July although DESC and its Technical Workgroup are provided with regular updates at certain key checkpoints and must provide their approval at each stage – see proposed timetable below:

Phase	Approx. Dates	Interaction / Decisions	Made by
Approach to modelling	Winter 19/20	Agree the approach to Gas Demand EUC Modelling for the 2020/21 Gas Demand Profiles, allowing back runs to be completed and new year modelling.	Technical Workgroup and DESC
Daily Gas Consumption Data validation	20/04/20 to 27/04/20	Agree Gas Demand EUC Modelling runs based on collected data aggregations and WAR band definitions.  TWG meeting scheduled for 27/04/20	Technical Workgroup
Gas Demand EUC Modelling	28/04/20 to 15/05/20	Possible that any issues with the regression analysis need to be reviewed promptly with consensus decisions made quickly.	Technical Workgroup
Gas Demand EUC Modelling	18/05/20 to 18/05/20	Review of all resulting Gas Demand EUC Models. Decisions likely to be required on which models are best for certain EUC/LDZ combinations. Choice of models will be offered that the group shall be required to select.  TWG meeting scheduled for 18/05/20	Technical Workgroup
Draft Gas Demand Profiles	08/06/20 to 26/06/20	Review will be required of the draft Gas Demand Profiles for all EUCs such as Annual Load Profiles and Daily Adjustment Factors.	Technical Workgroup and DESC
Draft Gas Demand Profiles	29/06/20 to 06/07/20	Review and discuss responses to comments from previous phase. Consensus required prior to releasing Gas Demand Profiles for wider industry review.  TWG and DESC Meeting scheduled for 06/07/20	Technical Workgroup and DESC
Final Gas Demand Profiles	20/07/20 to 24/07/20	Industry representations to be reviewed along with an agreed response before finalising the Gas Demand Profiles.  DESC Meeting scheduled for 22/07/20	DESC

**Fall-back Position:**

Section H of UNC states that, in the event DESC does not wish to approve the proposed Gas Demand Profiles (ALPs, DAFs and Peak Load Factors) derived from this year's process, then DESC has the option of rejecting them and using the 'fall-back' position. The fall-back position for the coming year would normally be the use of EUC definitions and Gas Demand Profiles based on the underlying Gas Demand EUC Models from the previous year's analysis.

Therefore, the fall-back position that would apply is that EUC definitions and Gas Demand Profiles applied to gas year 2020/21 would be based on the underlying Gas Demand EUC Models from the 2019 analysis. For the avoidance of doubt, the fall-back proposals will use the actual weekend and holiday dates for gas year 2020/21 and would be available using the rules applicable post the implementation of UNC Modification 0432 (Project Nexus – Gas Demand, Allocation, Settlement and Reconciliation reform).

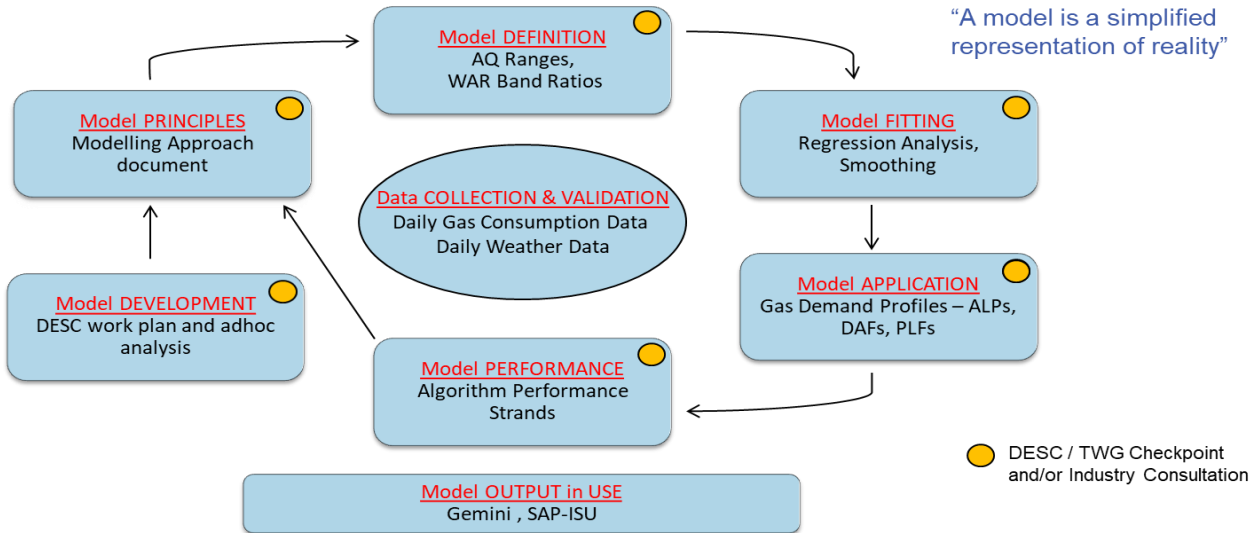
**End of Main Document**

APPENDIX

Appendix 1 - EUC Demand Model Lifecycle

# Overview: EUC & Demand Model Lifecycle

The purpose of the **Gas Demand EUC Model** is to represent the behaviour and reactions of the **EUC Population**



## Appendix 2 –Daily Gas Consumption Data Validation

The following provides the proposed validation criteria for use against the Daily Gas Consumption Data in the 2020 Gas Demand EUC Modelling. Section 1 of the NDM Algorithms Booklet will contain further details of the validation process and outcomes

Small NDM: 0 to 2,196 MWh p.a.

Source	EUC Bands	Missing Days		Consecutive Zeros		Spike Ratios	
		Summer	Winter	Summer	Winter	Summer	Winter
Xoserve Managed sample (and any third party data)	01 and 02	15 or more	15 or more	N/A	33 or more	15:01	08:01
Network Managed sample (and any third party data)	02, 03	28 or more	28 or more	N/A	20 or more	13:01	05:01

Large NDM: >2,196 MWh p.a.

Source	EUC Bands	Missing Days		Consecutive Zeros		Spike Ratios	
		Annual	Winter	Annual	Winter	Annual	Winter
Network Managed sample (and any third party data)	05, 06, 07 and 08	40 or more	20 or more	N/A	20 or more	08:01	N/A

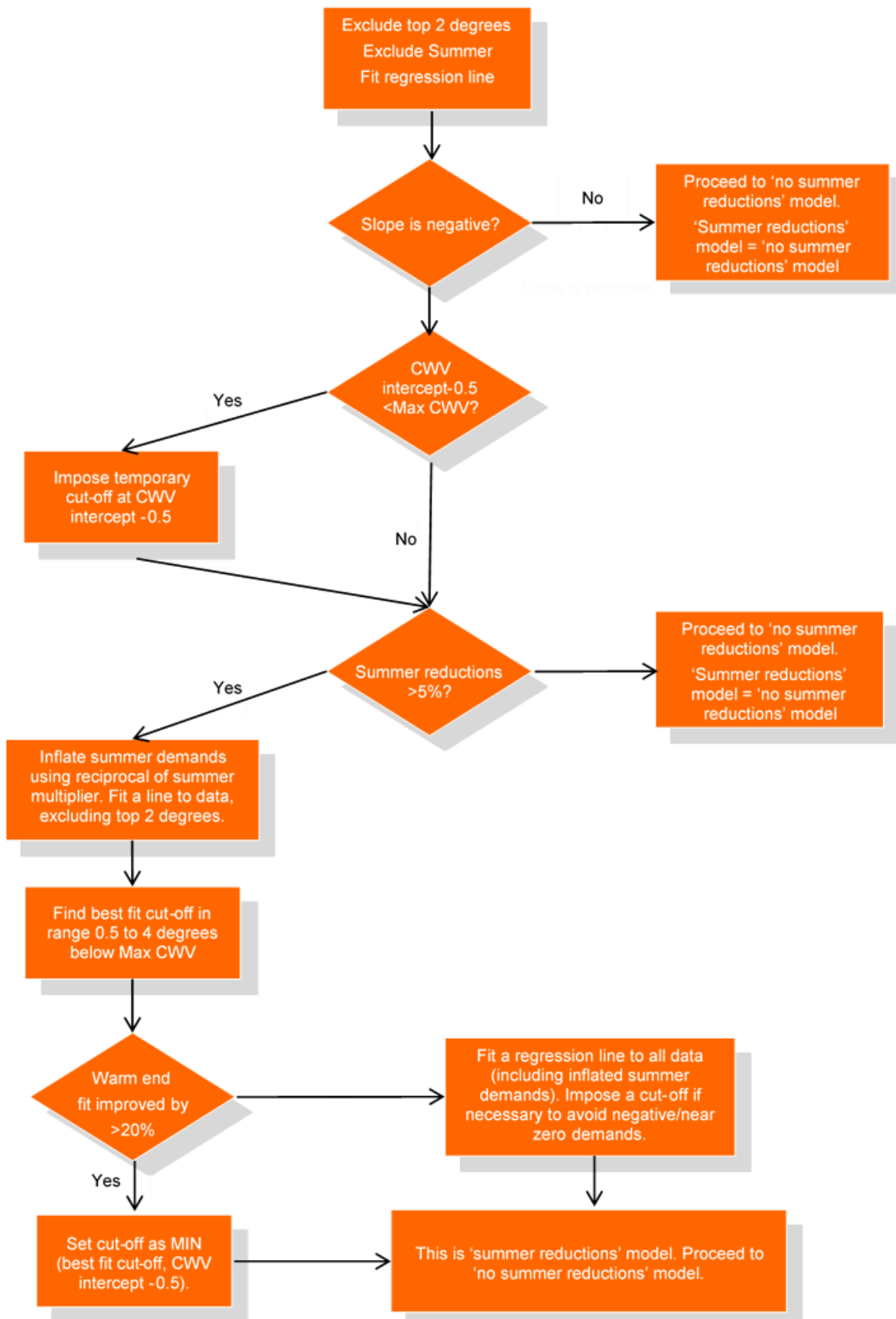
Where:  
 Summer period is defined as 1st April 2019 to 30th September 2019.  
 Winter period is defined as 1st October 2019 to 31st March 2020.  
 Annual period is defined as 1st April 2019 to 31st March 2020.

**Appendix 3 – Target Sample Size**

EUC Band	AQ Range (mWh)	Customer Type	LDZ													Total
			SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW	
01	up to 73.2	Domestic	384	384	384	384	384	384	384	384	384	384	384	384	384	4,992
		I&C	381	379	382	380	381	381	364	377	381	382	382	381	380	4,930
		PrePayment	384	383	384	383	383	383	380	383	383	384	384	383	383	4,978
02	73.2 to 293	I&C	374	367	377	371	375	375	322	358	373	377	376	373	371	4,789
		Domestic	348	316	353	337	348	344	160	272	348	367	364	342	332	4,231
		PrePayment	141	85	155	98	145	171	17	77	104	186	144	76	86	1,485
03	293 to 732	All	355	333	358	338	353	352	220	297	347	362	355	347	338	4,355
04	732 to 2,196	All	325	270	324	285	315	317	145	235	307	340	315	302	284	3,764
05	2,196 to 5,860	All	220	150	227	169	207	214	50	113	183	257	196	167	147	2,300
06	5,860 to 14,650	All	118	78	128	97	137	111	24	47	89	138	81	82	89	1,219
07	14,650 to 29,300	All	66	38	80	48	80	55	16	22	47	47	35	35	40	609
08	29,300 to 58,600	All	35	21	63	24	63	41	7	21	35	28	18	19	28	403
		Total	3,130	2,803	3,215	2,915	3,172	3,128	2,089	2,586	2,981	3,251	3,033	2,891	2,862	38,056

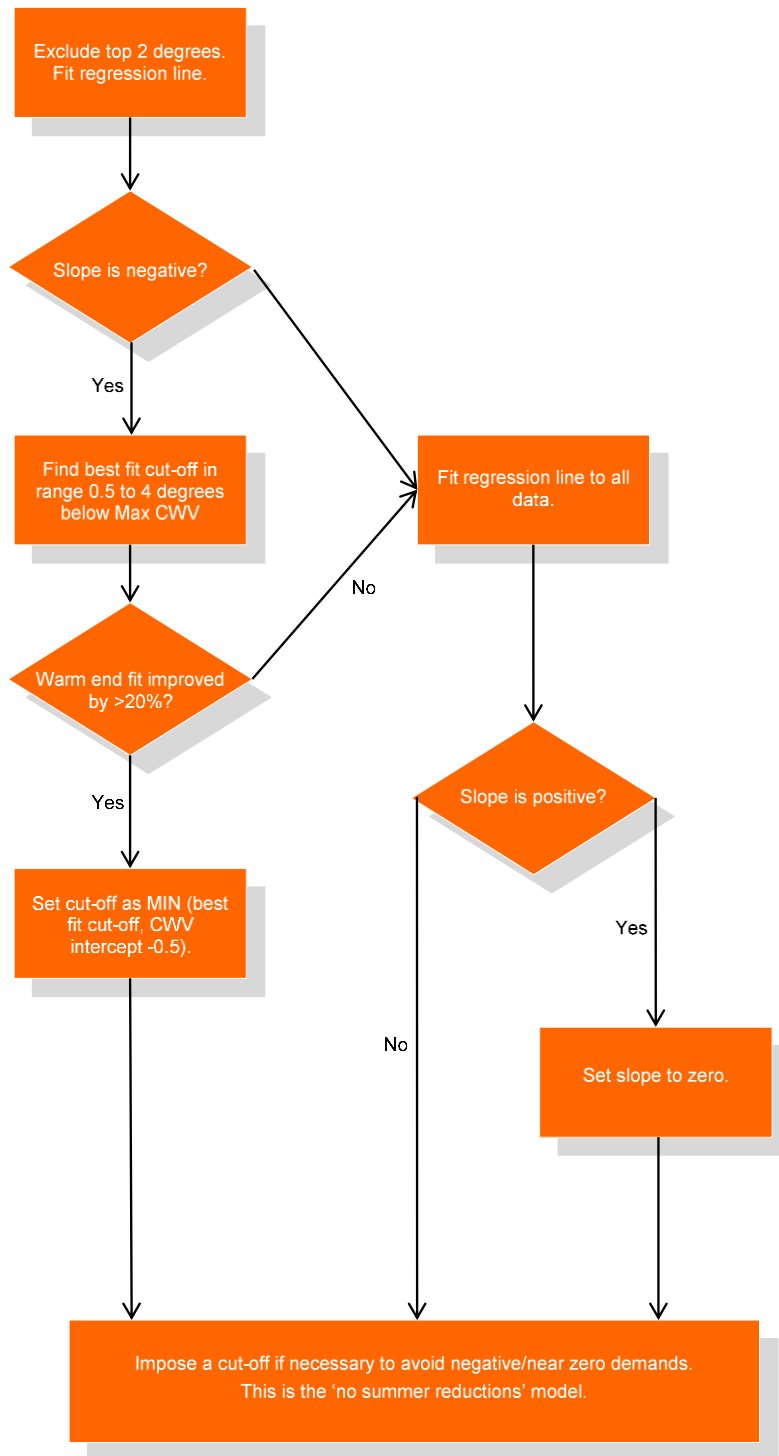
Appendix 4 – Gas Demand EUC Modelling Approach (Potential Summer Reductions)

MONDAY-THURSDAY MODEL WITH POTENTIAL SUMMER REDUCTIONS



Appendix 4 – Gas Demand EUC Modelling Approach (No Summer Reductions)

MONDAY-THURSDAY MODEL WITH NO SUMMER REDUCTIONS



**Appendix 5 – Holiday Code Rules**

Proposed holiday periods and codes for use in 2020 Gas Demand EUC Modelling

**Christmas/New Year (Holiday codes 1, 2, 3, 4, and 5)**

Holiday period starts on the Monday before 25th December (but if 25th December falls on a Monday, Tuesday or Wednesday, starts on the Friday before 25th December) and ends on the first Friday on or after the second New Year bank holiday in Scotland.

**Holiday code 1:**

25th December

**Holiday code 2:**

26th December, January 1st and any remaining bank holidays (except second Scotland New Year bank holiday) and any other Saturdays and Sundays in the period

**Holiday code 3:**

Any remaining Mondays to Fridays between 24th December and day before second Scotland New Year bank holiday inclusive

**Holiday code 4:**

Remaining days before 24th December

**Holiday code 5:**

Remaining days (will always include second Scotland New Year bank holiday)

**Easter (Holiday codes 6, 7 and 8)**

From Wednesday before Good Friday to the Friday after Good Friday (10 days).

**Holiday code 6:**

Easter Saturday and Easter Sunday

**Holiday code 7:**

Good Friday and Easter Monday

**Holiday code 8:**

All other days in the period above.

**First Bank Holiday in May (Holiday codes 9 and 10)**

From Saturday immediately preceding bank holiday, for 9 days in total. (Holiday runs from Saturday to Sunday).

**Holiday code 9:**

First bank holiday in May; Saturdays and Sundays in period above.

- Note Friday 8<sup>th</sup> May 2020 (VE Bank Holiday) will be treated as Holiday Code 9 as per DESC agreement

**Holiday code 10:**

All other days in period above.

**Spring Bank Holiday (Holiday codes 11 and 12)**

From Sunday immediately preceding bank holiday, for a week.

**Holiday code 11:**

Spring bank holiday; Saturdays and Sundays in period above

**Holiday code 12:**

All other days in period above.

**General Summer Holiday (Holiday codes 13 and 14)**

17 days from first Friday on or after 19th July.

**Holiday code 13:**

Saturdays and Sundays in period above.

**Holiday code 14:**

All other days in period above.

**August Bank Holiday (Holiday codes 15 and 16)**

From Sunday 8 days before bank holiday to Tuesday immediately after bank holiday.

**Holiday code 15:**

August bank holiday; Saturdays and Sundays in period above.

**Holiday code 16:**

All other days in period above.

**Special Codes for Summer Reductions**

These special codes are used for certain EUCs where summer reductions need to be modelled.

All non holiday days over the period from the start of the England and Wales Spring Bank Holiday period above to the to the last Sunday in September are assigned the following codes:

**Holiday code 17:**

Non holiday Monday to Thursdays in this summer reductions period

**Holiday code 18:**

Non holiday Fridays in this period

**Holiday code 19:**

Non holiday Saturdays in this period

**Holiday code 20:**

Non holiday Sundays in this period



## Appendix 6 - Demand Model Smoothing

The key stages of the end user category (EUC) Demand Model Smoothing process are explained below. This is unchanged from previous practice.

Produce models for the EUC based on the data for each of the last three years. In the case that summer reductions have been applied in an individual year, two versions of the Gas Demand EUC Model for that year exist, one with summer reductions and one without summer reductions. Where summer reductions are applied, the magnitude of these reductions is expressed in terms of a summer multiplier applied to the fitted daily demands over the non holiday days from the spring bank holiday period to the last weekend in September. For example, a summer multiplier of 0.870 means that fitted demands are reduced by 13% over this period. If no summer reductions are applied, the summer multiplier takes a value of 1.

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.

For example, for an EUC with summer multipliers of 1.000 (i.e. no summer reductions), 0.820, and 0.840 in the individual years, the average summer multiplier is 0.887. This is less than the critical value of 0.9, so a summer reduction is applied to the smoothed model.

This decision process allows a unique Gas Demand EUC Model to be selected for each individual year. If summer reductions are to be applied in the smoothed model, the version of each individual year's model with summer reductions (if such a version exists) is selected. Otherwise, the version without summer reductions is selected for each individual year.

At this stage, the decision as to whether to set weekend effects to zero is taken.

The selected individual year models for the EUC are standardised, by dividing through by the constant for that individual year. This gives a model for each year (yr) of the form:

$$Dt(yr) = 1 + C2(yr)*CWVt + C3(yr)*Fri + C4(yr)*Sat + C5(yr)*Sun$$

This standardisation ensures that all three individual year models give the same normalised daily demand value (i.e. 1.0) for a non-holiday Monday to Thursday at 0° CWV. This ensures that equal weight is given to each individual year in the smoothing process.

Each individual parameter of the initial smoothed model for the EUC is calculated by averaging the values of the parameter over the three individual years.

For example,  $C2(\text{smoothed}) = \{C2(\text{yr. 1}) + C2(\text{yr. 2}) + C2(\text{yr. 3})\}/3$

The constant (which is 1 in the standardised model) and the slope of the smoothed model are then multiplied by the constant term of the original (unstandardised) model for the most recent year. Note that this step has no effect on the NDM profiling or capacity estimation parameters, but it gives model parameters of the same scale as that of the model for the most recent individual year.

The multiplicative day of week/holiday factors (Pt as described in Section 3 of the spring 2019 NDM Algorithms booklet) are calculated for the smoothed model for the EUC. These are calculated for each day as averages of the corresponding values in the three individual years' models.

A decision is made as to whether to apply a composite weather variable cut-off to the smoothed model for the EUC. Application of a CWV cut-off has the effect of causing the fitted demand to level off for values of CWV above the cut-off. The criterion used in making the decision is as follows. The value of the CWV cut off is estimated for each year's model. If no cut-off is required, the cut-off value for that year is set to the maximum CWV for the LDZ. The three individual years' CWV cut-offs are then averaged. If this average value is less than the maximum CWV for that LDZ, a CWV cut-off is set at this value in the smoothed model. Otherwise no CWV cut-off is applied to the smoothed model. Note however that cut-offs will not be applied to the models derived for consumption bands up to 293 MWh pa, for the 2020 analysis. This amended approach was agreed by DESC in December 2003, with a view to mitigating instability during the summer and has been applied to all NDM analyses since spring 2004.

The ensuing form of model is used in the calculation of the Gas Demand Profiles.

A form of the smoothed model is also produced with additive weekend effects. The averaged standardised parameters for each day from Friday to Sunday are multiplied by the constant term of the original unstandardised model for the most recent year, to give additive weekend effects for the smoothed model.

This gives a smoothed model of the form:  $Dt = C1 + C2*CWVt + C3*Fri + C4*Sat + C5*Sun$

C1 as the same value as the constant term of the EUC model for the most recent year. This is a simple form of the smoothed model because it does not embody such features as holiday effects, summer cut-offs and summer reductions. The parameter values for this form of model will be shown in the 2020 NDM Algorithms booklet.