Demand Estimation Sub Committee

2.0 Gas Demand EUC Modelling Results
(1 of 3) Introduction
24 May 2023

Contents

2.0 Gas Demand EUC Modelling Results

BACKGROUND, TIMETABLE, AND OBJECTIVE OF MEETING

Overview

- An overview of the Demand Estimation process and output can be found here
- Annual modelling cycle of activities are represented in diagram opposite
- This presentation relates to the “Modelling” phase of the Demand Model cycle

CDSP / DESC Obligations and Timetable: October 2022 to September 2023

Milestone	UNC H Ref	2022			2023								
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
DESC Membership confirmed	1.12	✔											
NDM Sampling: Data Collection and Validation	1.6	✔						✔					
NDM Algorithm Performance for Gas Year 2021/22	1.8			✔								✔	
DESC Adhoc Workplan	1.7	✔		✔			✔						
DESC Modelling Approach – EUCs and Demand Models	1.7			✔			✔						
Single Year EUC Demand Modelling	1.7								✔				
Model Smoothing and Draft Gas Demand Profiles	1.7									✔			
Industry Consultation	1.8									✔	✔		
Gas Demand Profiles finalised and Core systems updated	1.9											✔	
Climate Change Methodology progressed (SN Review 2025)	1.4			✔			✔		✔		✔		

Objectives

- The objective of the “Modelling” phase is to review the outcomes for all Gas Demand Models and confirm which should be used in Demand Model Smoothing

- Objective of today’s meeting is for DESC to:

  - Review Gas Demand Modelling results for both Small and Large NDM EUC Bands

– Where more than one set of results has been produced for an EUC, confirm which should be selected	DESC Approval

– Confirm you are satisfied with all Gas Demand Models that have been selected for deployment in the next activity, namely Demand Model Smoothing	DESC Approval

2.0 Gas Demand EUC Modelling Results

MODELLING APPROACH

Modelling Approach – Basis of 2023 Modelling (1 of 2)

Key aspects of DESC's Modelling Approach 2023 are summarised below:

- Demand modelling runs and any necessary aggregations (following validation and selection) were agreed by DESC in April
- The Composite Weather Variable (CWV) definitions and Seasonal Normal basis (SNCWV), effective from 1st October 2020, will be used
- All gas demand modelling is data driven – if the modelling results indicate then Holiday & Weekend Factors, Summer Reductions & Cut-Offs will be applied
- Holiday Factors are determined using the rules agreed by DESC on 2nd March 2022, following a review of the Holiday Code Rule definitions in the Autumn/Winter 21/22 Adhoc Workplan
- In line with recent years, holidays have been excluded from the regression models for Domestic EUCs

Modelling Approach – Basis of 2023 Modelling (2 of 2)

- Warm-weather cut-offs:
  - Not applied to EUC models < 293 MWh pa, meaning no cut-off is placed on warm weather demand reduction in EUC models representing nearly 80% of NDM load
  - Any cut-offs are based on modelling results from 3 years

- Summer Reductions:
  - Summer reductions can apply to EUC models over the period from the Sunday before Spring Bank Holiday Monday to last Sunday in September – i.e. 29th May 2022 to 25th September 2022
  - Above applies along with the more general summer holiday period in July and August
  - Any summer reductions are based on modelling results over 3 years

- Modelling methodology in NDM Algorithms Booklet (Sections 3 & 4)

2.0 Gas Demand EUC Modelling Results

ANALYSIS PERIOD TIMELINE

Analysis Period Timeline – Points of Note (1 of 2)

- As agreed by DESC in the Modelling Approach, this year's Analysis Period runs from 1st April 2022 to 31st March 2023. The 12-month period was chosen to ensure we had sufficient Easter Holiday data points to calculate relevant Holiday Factors

- Prior to reviewing the Small and Large NDM EUC Modelling results for this period, it is worth recalling any significant external factors that may have had an impact which could explain any outliers - these include extreme weather events and increases in Gas Prices

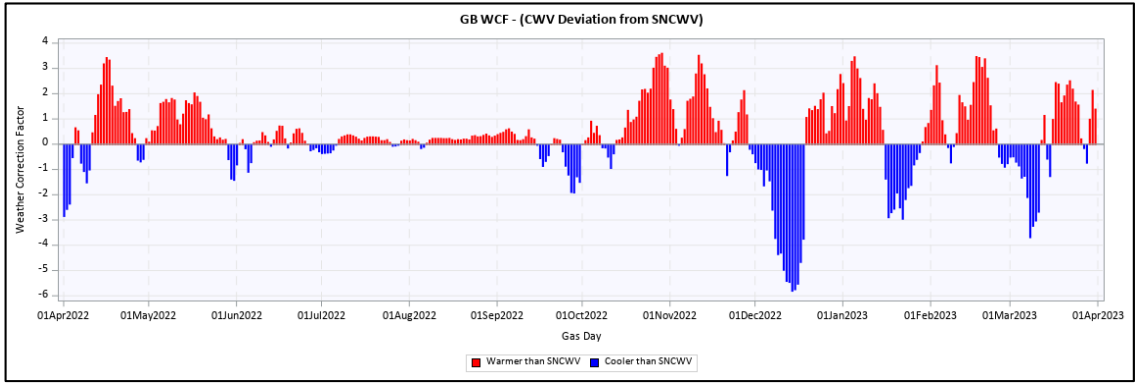
- During the analysis period, average AQs for Band 1 Domestic Non-Prepayment ("01BND") decreased every month

- Since March 2022 the average "01BND" EUC AQ has **declined by c.17%,** real figure is likely to be more given there are c.2.71m Supply Meter Points (10.8% of NDM population) with an AQ Effective Date pre October 2022

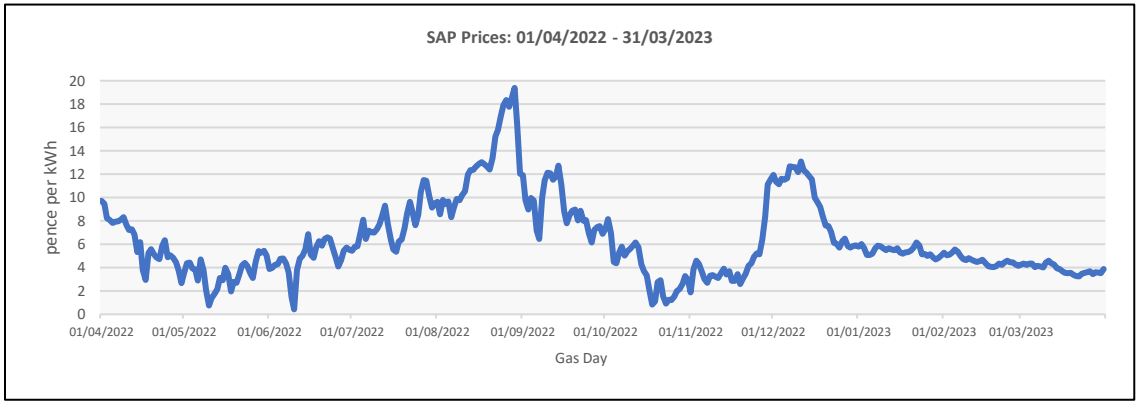
- These decreases are likely to be caused by an increase in wholesale gas prices.

Analysis Period Timeline – Points of Note (2 of 2)

- Chart of GB Weather Correction Factor (WCF) for Analysis Period opposite
- Spike of much colder than Seasonal Normal weather mid December 2022
- August 2022 was warmest August on record, October 2022, November 2022, and February 2023 were all 3rd warmest on record (gas industry records)



- Wholesale Gas Prices increased significantly during Analysis Period
- Consumer behaviour changes are present as a result
- See chart of System Average Price (SAP)



2.0 Gas Demand EUC Modelling Results

MEASURES

Measures – What are they?

- Analysis carried out aims to assist in the creation of profiles based on the relationship between demand and weather
- Opportunity to view results so far and identify the best fit model based on available Daily Gas Consumption Data
- The key measures used to identify most appropriate model are:
  - R squared (R^2) Multiple Correlation Coefficient
    - Statistical tool for identifying 'goodness of fit' (includes plot of seasonal residuals)
    - Value will range from 0 to 100% (100% indicating a perfect fit / direct relationship)
  - Indicative Load Factors (ILFs)
    - ILFs indicate the weather sensitivity of a model
    - Values are expected to be comparable across individual EUCs
- Additional Model Summary Insight
    - Scatter Correlation plot; Residuals Histogram; Time series of Actual and Fitted demands

Measures – Indicative Load Factors

- Indicative Load Factors (ILFs) provide an indication of the weather sensitivity for a Gas Demand Model
- ILFs are only used to compare prospective Gas Demand Models as an aid to making decisions on model choice
- It is expected that there should be distinguishable ILF values between EUC consumption bands and WAR bands
- ILFs are not the same as proper Peak Load Factors (PLFs) and their values are not an indicator of the values of proper PLFs (ILFs not used for determining NDM capacities). Formulas below:
  - PLF = average daily demand (i.e. AQ/365) / 1 in 20 peak demand
  - ILF = (AQ/365) / model demand corresponding to 1 in 20 CWV

Measures – Examples

- The table on the right shows an example of how the R^2, Sample Size and ILF results are presented for each EUC
- R^2 and ILF results have been compared to the average of the previous 2 years used Analysis Periods (years vary by Model and is covered in the slide text)
- R^2 arrows and colours indicate the following movements

↑	Greater than 2.5% increase
↗	less than 2.5% increase
↔	No change
↘	less than 2.5% decrease
↓	Greater than 2.5% decrease

- ILF arrows and colours indicate the following movements

↑	ILF has increased (less weather sensitive)
↔	ILF is unchanged
↓	ILF has decreased (more weather sensitive)

- Sample sizes are illustrated using a coloured circle

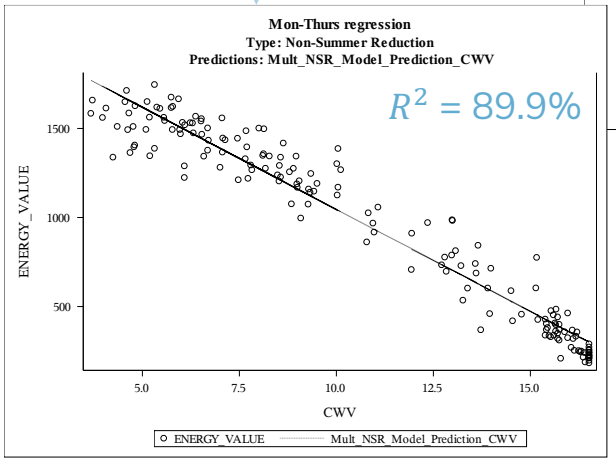
🔴	Sample size below minimum of 30 sample meter points
🟢	Sample size above minimum but below target
🟢	Sample size meets target

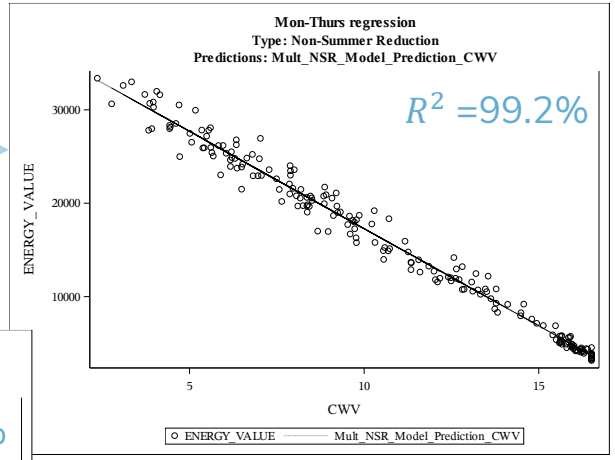
	R^2			Sample Size		ILF		
LDZ	Avg. prev 2 years	2022/23		2022/23		Avg. prev 2 years	2022/23	
SC	98.2%	↘	**97.2%**	🟢	**256**	37.4	↓	**37.1**
NO	94.0%	↑	**98.5%**	🟢	**383**	38.0	↔	**38.0**
NW	97.4%	↗	**98.3%**	🟢	**385**	35.3	↓	**34.2**
NE	97.8%	↗	**98.3%**	🟢	**385**	35.9	↑	**36.1**
EM	98.8%	↘	**98.7%**	🟢	**306**	33.9	↓	**31.9**
WM	98.5%	↓	**92.0%**	🟢	**359**	33.5	↔	**33.5**
WN	96.8%	↗	**98.0%**	🟢	**224**	35.4	↓	**33.4**
WS	95.0%	↑	**99.4%**	🟢	**248**	33.8	↓	**32.4**
EA	98.4%	↗	**98.7%**	🔴	**25**	33.4	↓	**31.1**
NT	99.0%	↘	**99.0%**	🟢	**202**	34.4	↑	**37.3**
SE	98.8%	↓	**96.0%**	🟢	**268**	32.6	↑	**33.3**
SO	98.4%	↗	**98.7%**	🟢	**244**	30.3	↓	**27.8**
SW	98.1%	↗	**98.8%**	🟢	**385**	30.6	↓	**29.1**

Measures – R-Squared and Residuals Example

Plot of Demand vs CWV and Line of Best Fit

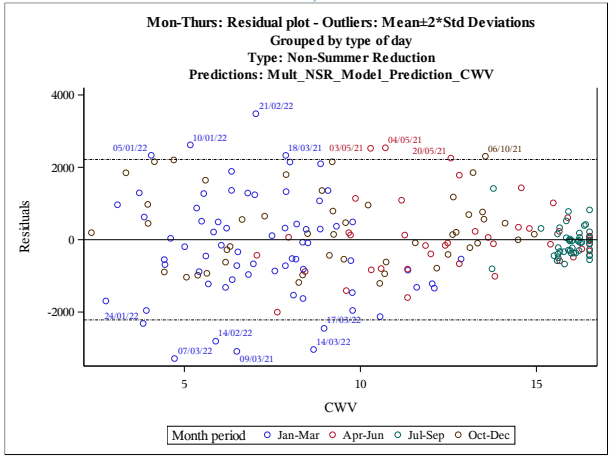
Provides view of EUC Demand Model Performance (R^2)



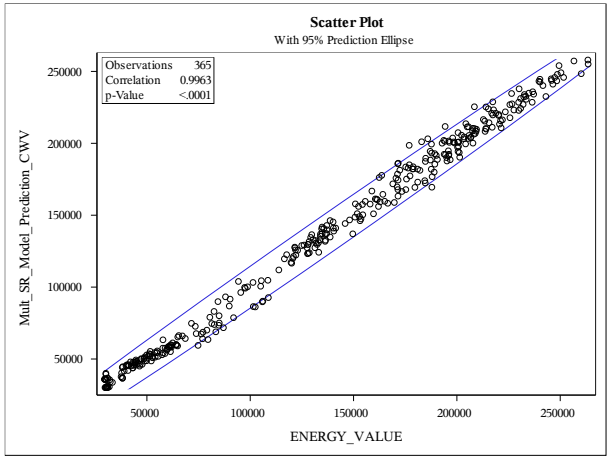


Plot of Seasonal Residuals

View of any potential seasonal bias and labelled outliers



Measures – Additional Model Summary Insight Examples

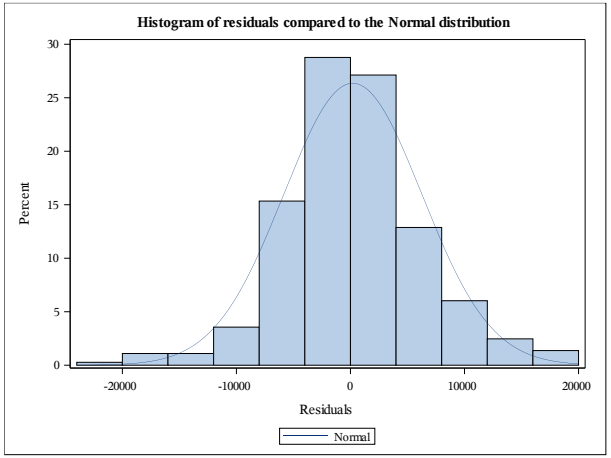


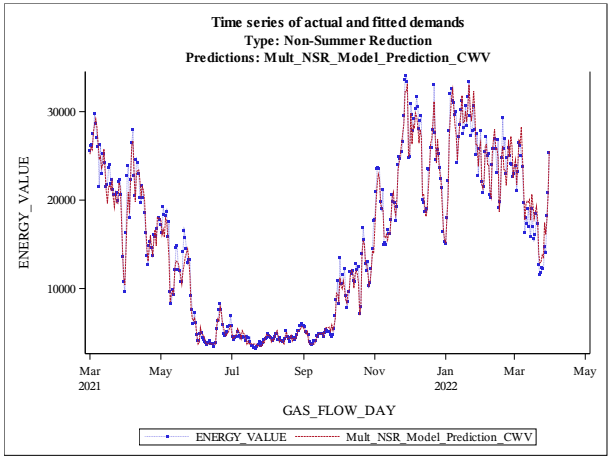
Scatter Correlation Plot

View of the Actual Demand vs Fitted Demand correlation

Residuals Histogram

Assessment of residuals compared to Normal distribution





Time Series of Actual & Fitted Demands

Time series of model performance