Modelling Results - Introduction

Demand Estimation Sub Committee

Technical Workgroup

24/05/2021

Provided by:

Contents

Slide Pack 1:

Slide Pack 2:

Slide Pack 3:

Section 1:
Background, Timetable, and Objectives of Meeting

Demand Estimation: Background

- An overview of the Demand Estimation process and output can be found [here](#)

- This presentation relates to the "Model Fitting" phase of the Demand Model cycle
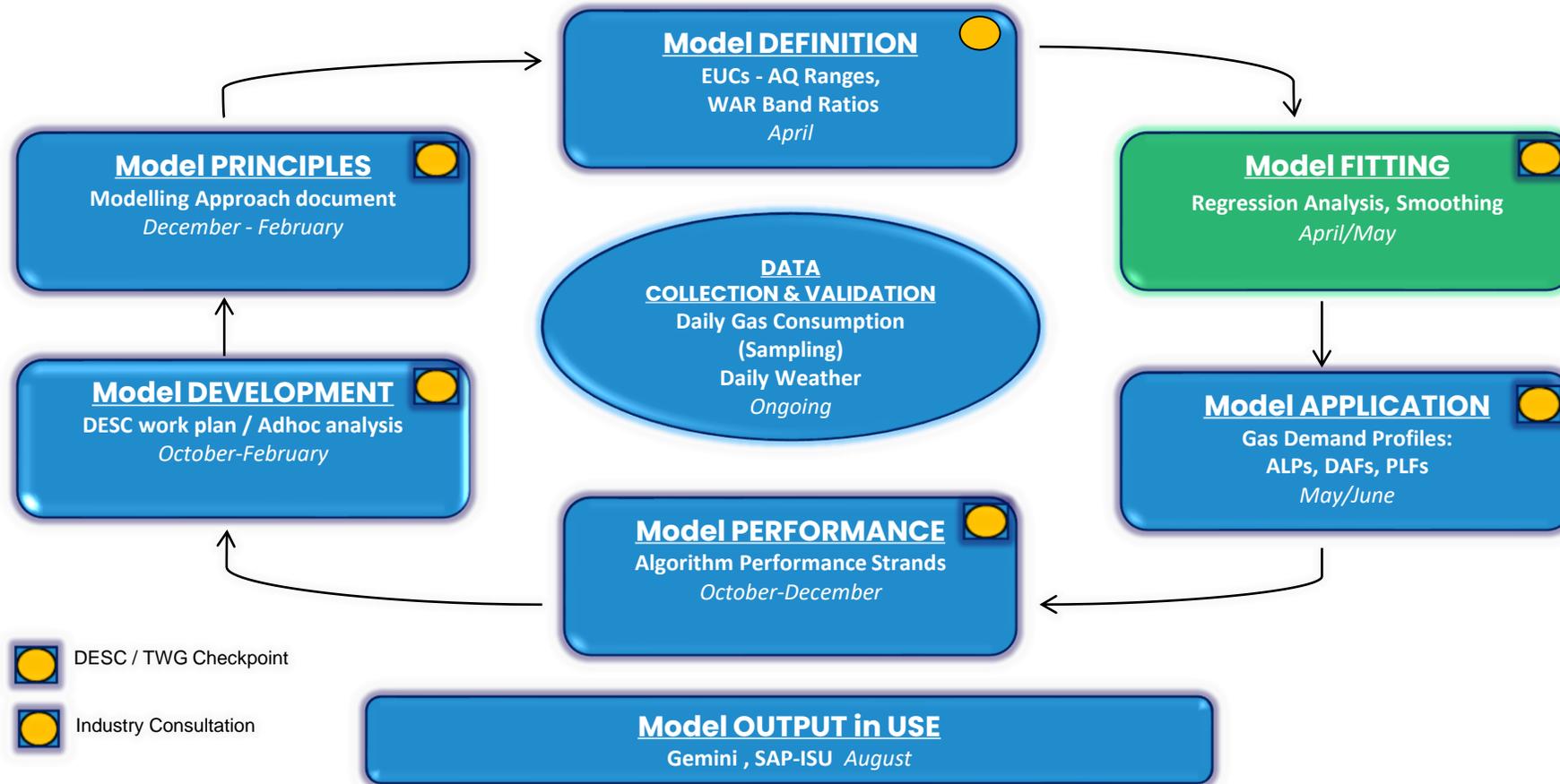
Demand Estimation: Timetable - 2021

High Level View of Demand Estimation Timetable 2021 - Key Checkpoints

PHASE	JAN'21	FEB'21	MAR'21	APR'21	MAY'21	JUN'21	JUL'21	AUG'21	SEP'21	OCT'21	NOV'21	DEC'21
1. MODEL PRINCIPLES												
Modelling Approach 2021 Approved (DESC)		24-Feb										
2. Data COLLECTION & VALIDATION												
Daily Gas Consumption Data validated (CDSP)				15-Apr								
3. MODEL DEFINITION												
Agree Data Aggregations / WAR Band Limits (TWG)				28-Apr								
4. MODEL FITTING												
Gas Demand EUC Modelling review (TWG)					24-May							
5. MODEL APPLICATION												
Publication of Draft Gas Demand Profiles (CDSP)						04-Jun						
Gas Demand Profiles Approved for wider industry (TWG/DESC)							07-Jul					
Final Approval of Gas Demand Profiles (DESC)							21-Jul					
6. MODEL OUTPUT IN USE												
SAP-ISU and Gemini updated (CDSP)								15-Aug				
7. MODEL DEVELOPMENT												
Adhoc Work-plan approved (DESC)							21-Jul			06-Oct		
8. MODEL PERFORMANCE												
NDM Algorithm Performance - Strands 1 to 3 reviewed (DESC)												14-Dec

Objectives of Meeting

- The objective of the "Model Fitting" phase is to review the outcomes for all Gas Demand Models and confirm which should be used in Demand Model Smoothing (a key input to the next phase "Model Application")

- Objective of today's meeting is for TWG 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

    - Confirm whether models are suitable to use given the impacts of COVID-19 to the consumption of gas in both Domestic and I&C Sectors

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

Section 2:
Modelling Approach

Modelling Approach – Basis of 2021 Modelling 1

- The principles for this year's Gas Demand Modelling is described in the 'Modelling Approach' document - approved by DESC in February

- Key aspects are:
  - Daily Gas Consumption Data was validated and, where necessary, selected in line with the stratification method

  - Demand modelling runs and any necessary aggregations (following validation and selection) were agreed by TWG in April

  - The Composite Weather Variable (CWV) definitions and Seasonal Normal basis (SNCWV), effective from 1st October 2020, will be used

  - Holiday codes and rules applicable to Christmas / New Year period are same as used in Spring 2020 (changes last made at Nov 2011 DESC)

  - In line with last year, holidays have been excluded from the regression models for Domestic EUCs

  - All gas demand modelling is data driven – if the modelling results indicate then Holiday & Weekend Factors, Summer Reductions & Cut-Offs will be applied
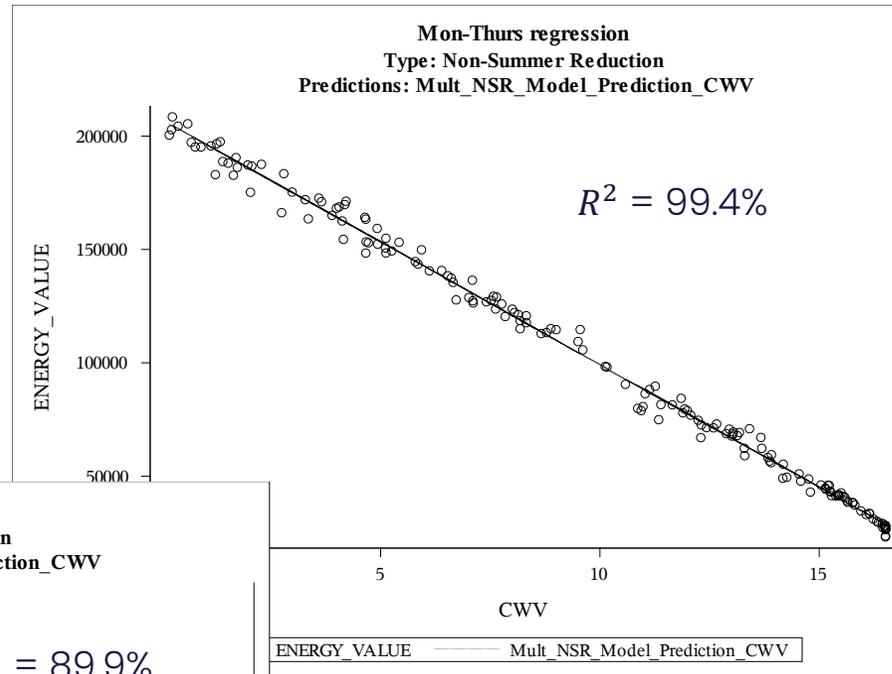
Modelling Approach – Basis of 2021 Modelling 2

- 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. 24th May 2020 to 27th September 2020
  - 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)

- The Gas Demand Modelling performed this year will be the second set of analysis to be performed using the newly implemented Demand Estimation EUC Gas demand modelling system
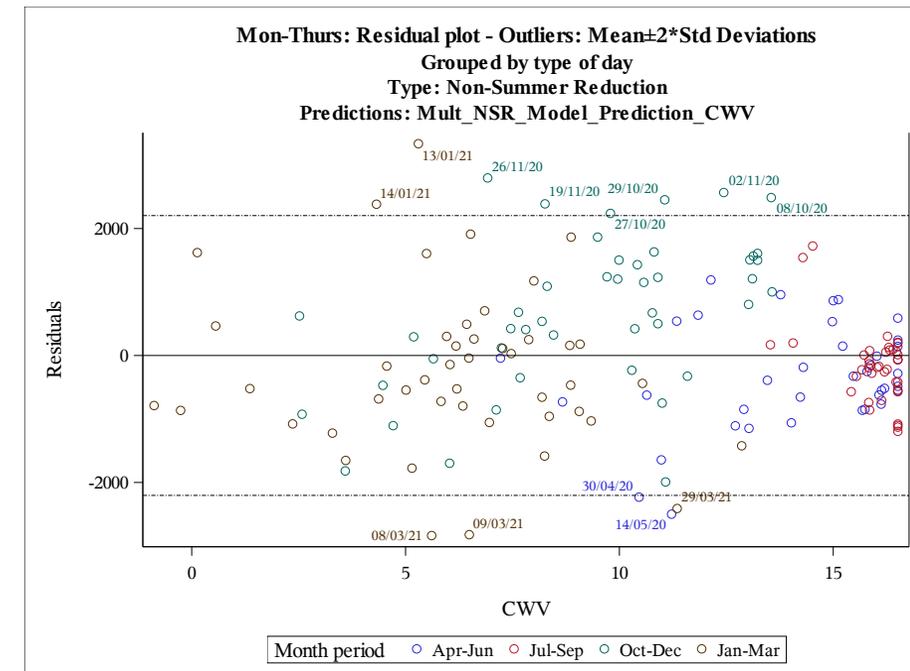
Section 3: Measures

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:

  - <u>R squared (R^2) Multiple Correlation Coefficient</u>
    - 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)

  - <u>Indicative Load Factors (ILFs)</u>
    - ILFs indicate the weather sensitivity of a model
    - Values are expected to be comparable across individual EUCs

  - <u>Additional Model Summary Insight</u>
    - Scatter Correlation plot; Residuals Histogram; Time series of Actual and Fitted demands

Measures – R Squared Example

Mon-Thurs regression
Type: Non-Summer Reduction
Predictions: Mult_NSR_Model_Prediction_CWV

$R^2 = 99.4\%$

Mon-Thurs regression
Type: Non-Summer Reduction
Predictions: Mult_NSR_Model_Prediction_CWV

$R^2 = 89.9\%$

Plot of Seasonal Residuals
View of any potential seasonal bias and labelled outliers

Mon-Thurs: Residual plot - Outliers: Mean±2*Std Deviations
Grouped by type of day
Type: Non-Summer Reduction
Predictions: Mult_NSR_Model_Prediction_CWV
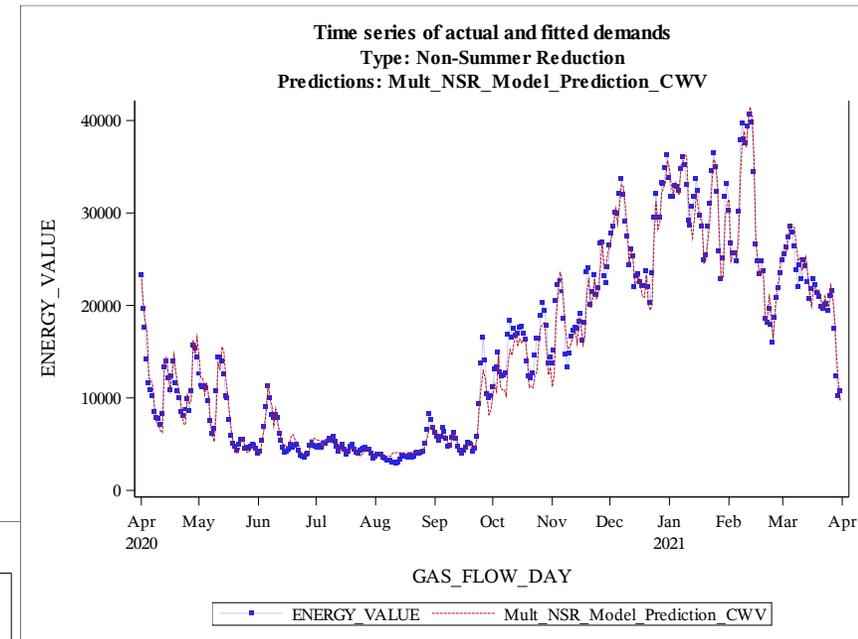
Measures – Indicative Load Factors (ILFs)

- 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 – Additional Model Summary Insight Example

Scatter Plot
With 95% Prediction Ellipse

Observations	365
Correlation	0.9963
p-Value	<.0001
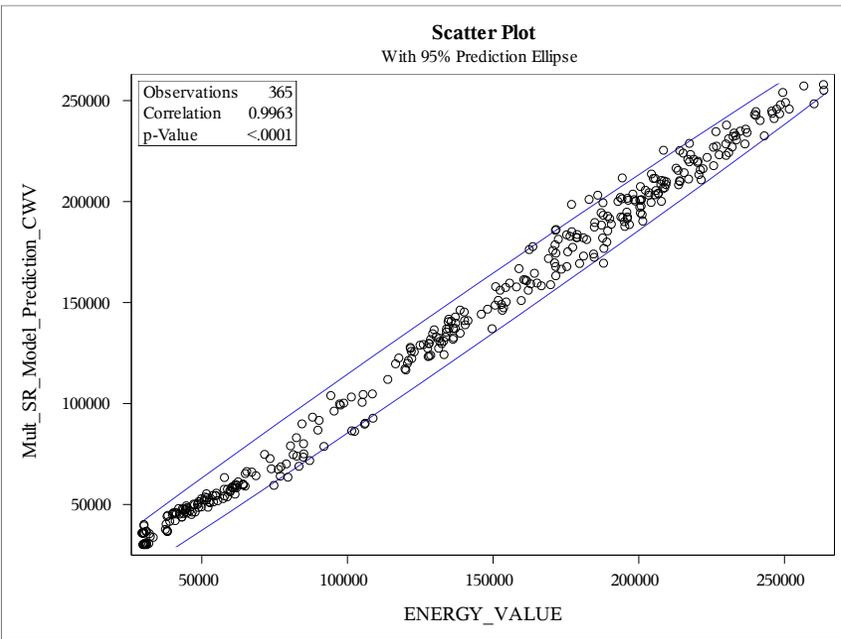
Scatter Correlation Plot
View of the Actual Demand vs Fitted Demand correlation

Residuals Histogram
Assessment of residuals compared to Normal distribution

Histogram of residuals compared to the Normal distribution

Time series of actual and fitted demands
Type: Non-Summer Reduction
Predictions: Mult_NSR_Model_Prediction_CWV
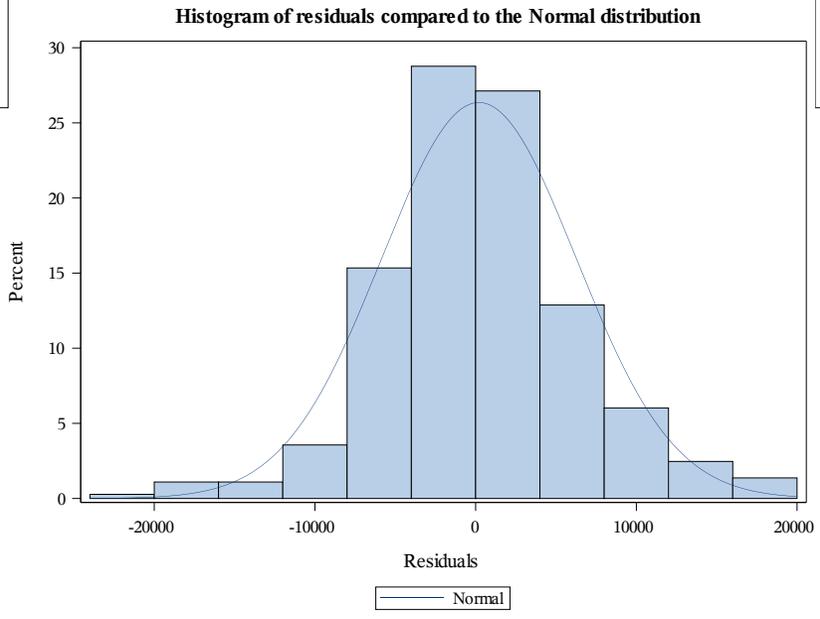
Time Series of Actual & Fitted Demands
Time series of model performance

Section 4:
Impacts of COVID-19

Impacts of COVID-19

- The analysis period considered for this year's modelling is 1st April 2020 to 31st March 2021 which as highlighted on slide 17 covers a large period of COVID-19 restrictions

- Following February's DESC meeting, the Modelling Approach document was updated to reflect DESC's views that it did not wish to use the sample data for the I&C EUCs but would keep an open mind on the Domestic EUCs, pending the results

- As explained in communications shared with TWG on 11th May, there has been a noticeable deterioration in the modelling results across the I&C sector, when compared to previous analysis years. Domestic EUC modelling results appear to be more in line

- To illustrate the impacts of COVID-19 on the EUC Gas Demand Models, we have included a comparison of the movement in R^2 and ILF values from the most recent analysis period ('20/21) with an average of the previous 3 analysis periods ('17/18, '18/19, and '19/20)

- Results for the Domestic EUCs and options for their use will be considered first. The results for I&C EUCs have been provided for information and transparency given DESC has already indicated strongly it will not be using this year's output

- The following slide provides a high level view of the key COVID restrictions which have occurred during this year's analysis period

COVID-19 Impact Timeline

National Lockdown begins Business premises, non-essential shops and schools close — March 2020

Some restrictions eased Non-essential retail reopened Sporting events permitted — June 2020

National Lockdown restrictions eased Hospitality and tourist attractions reopened UK holidays allowed — July 2020

Period of increased restrictions and local lockdowns begins — Sept 2020

2nd National Lockdown begins Non-essential shops close Hospitality becomes takeaway only — Nov 2020

Minor easing of restrictions over Christmas — Dec 2020

3rd National Lockdown began Non essential retail and schools closed again — Jan 2021

Phased lifting of lockdown restrictions begins — Mar 2021