



# **Demand Estimation Technical Work Group**

**Gas Demand EUC Modelling Results  
Gas Year 2020/21**

**(1 of 3) Introduction**

**22<sup>nd</sup> May 2020**

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# 1: Background – Gas Demand Estimation (1)

- Key industry processes require various types of gas demand estimation at NDM Supply Point level. These processes include:
  - Determining Supply Point Capacity
  - Daily Nominations and Allocations i.e. NDM Supply Meter Point Demand Formula
  - Determining Annual Quantities (AQs)
- To achieve this estimation, each NDM Supply Point belongs to an End User Category (EUC)
- EUCs are used to categorise NDM Supply Points in an LDZ and are defined by reference to variables which are maintained in the Supply Point Register
- Each EUC requires an associated Gas Demand Model which represents its gas usage characteristics e.g. weather sensitivity, consumption profile etc.
- Gas Demand Models are mathematical models which provides an estimate of gas demand for each EUC by reference to variables determined by DESC

# 1: Background – Gas Demand Estimation (2)

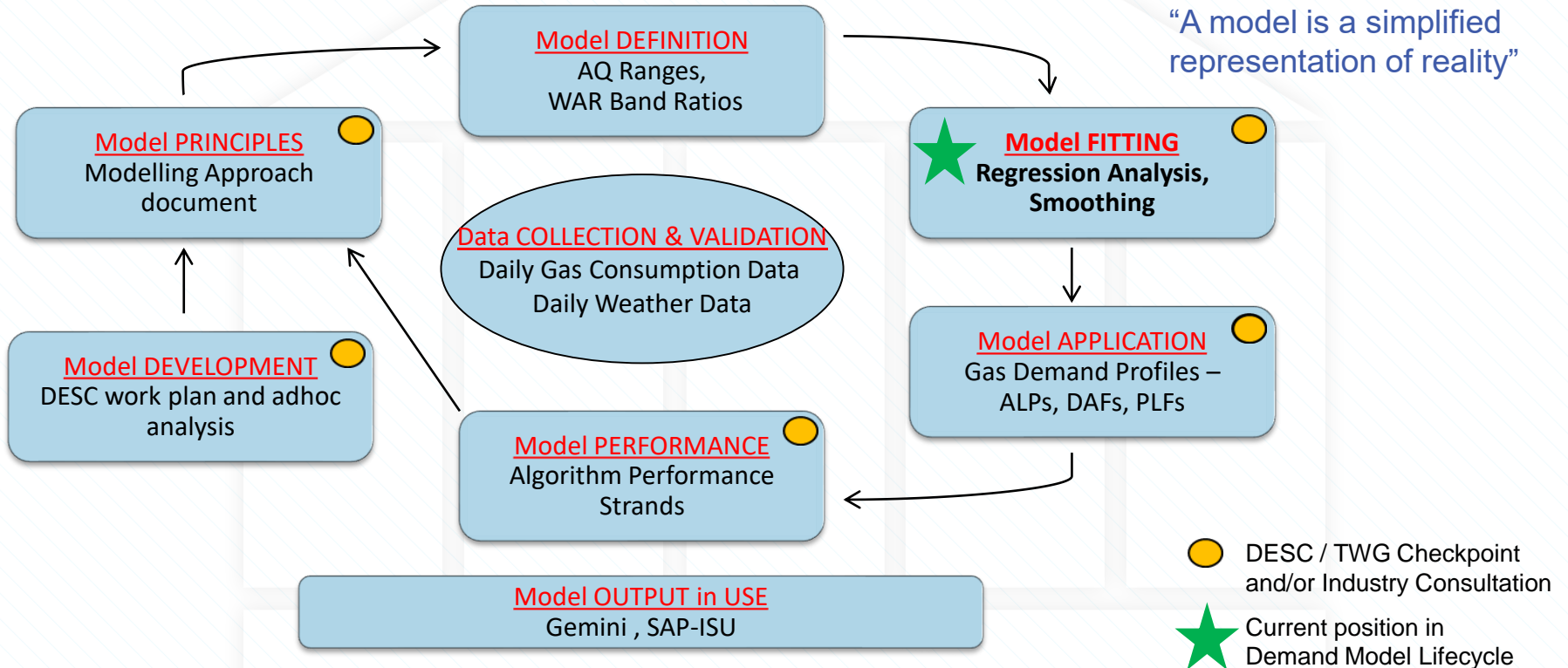
- For each Gas Year, DESC will develop or revise the definitions of the EUCs for the LDZ and the Gas Demand Models for each EUC. The CDSP will then implement these decisions
- The annual process for determining the EUCs and Gas Demand Models for the following gas year begins with the production of a document called the “Modelling Approach”
- The Modelling Approach provides an overview of the proposed EUC definitions and how the modelling shall be performed, including a reference to the Daily Gas Consumption Data required in order to produce the relevant gas demand models
- DESC approved the latest version of the Modelling Approach at its meeting in February
- Section H of UNC and the NDM Demand Estimation Methodology document provides more detail of the Demand Estimation process

# 1: Background - Timescales

- DESC's obligation of producing a set of End User Categories and Gas Demand Models for the next gas year has to be delivered within certain timescales:
  - The Daily Gas Consumption Data collected for analysis must include the most recent Winter period (December to March), meaning full data validation cannot start until early April
  - The Final EUCs and Gas Demand Models must be approved and submitted to the Authority and loaded to CDSP's systems by 15th August
  - In between April and August is when the Daily Gas Consumption Data validation results are reviewed, WAR Band ratios are set, Gas Demand Models are developed and reviewed, Demand Model Smoothing is applied, draft Gas Demand Profiles are produced and reviewed, followed by an industry consultation commencing early June
- The above explains why it is necessary to agree modelling principles and methodologies in February each year, as there is not time in the Spring/Summer to make fundamental modelling decisions and gain agreement from all DESC members

# 1: Background - EUCs and Demand Model Lifecycle

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



# 1: Background - Timetable of Key Checkpoints for 2020

High Level View of Demand Estimation Timetable 2020 - Key Checkpoints

PHASE	JAN'20	FEB'20	MAR'20	APR'20	MAY'20	JUN'20	JUL'20	AUG'20	SEP'20	OCT'20	NOV'20	DEC'20
1. MODEL PRINCIPLES												
Modelling Approach 2020 Approved (DESC)		10th Feb										
2. Data COLLECTION & VALIDATION												
Daily Gas Consumption Data validated (CDSP)				15th Apr								
3. MODEL DEFINITION												
Agree Data Aggregations / WAR Band Limits (TWG)				27th Apr								
4. MODEL FITTING												
Gas Demand EUC Modelling review (TWG)					22nd May							
5. MODEL APPLICATION												
Publication of Draft Gas Demand Profiles (CDSP)						12th Jun						
Gas Demand Profiles Approved for wider industry (TWG/DESC)							6th Jul					
Final Approval of Gas Demand Profiles (DESC)							22nd Jul					
6. MODEL OUTPUT IN USE												
SAP-ISU and Gemini updated (CDSP)								15th Aug				
7. MODEL DEVELOPMENT												
Adhoc Work-plan approved (DESC)							22nd Jul			5th Oct		
8. MODEL PERFORMANCE												
Strands 1 to 3 reviewed (DESC)												7th Dec

## 2: Objectives of Meeting

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



# 3: Modelling Approach - Basis of 2020 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
  - Data aggregations (following validation and selection) were agreed by TWG in April
  - A revised set of Composite Weather Variable (CWV) definitions and Seasonal Normal basis (SNCWV), effective from 1st October 2020, will be used (agreed by DESC at the end of 2019)
  - Holiday codes and rules applicable to Christmas / New Year period are same as used in Spring 2019 (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

# 3: Modelling Approach - Basis of 2020 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. 26<sup>th</sup> May 2019 to 29<sup>th</sup> September 2019
  - 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)

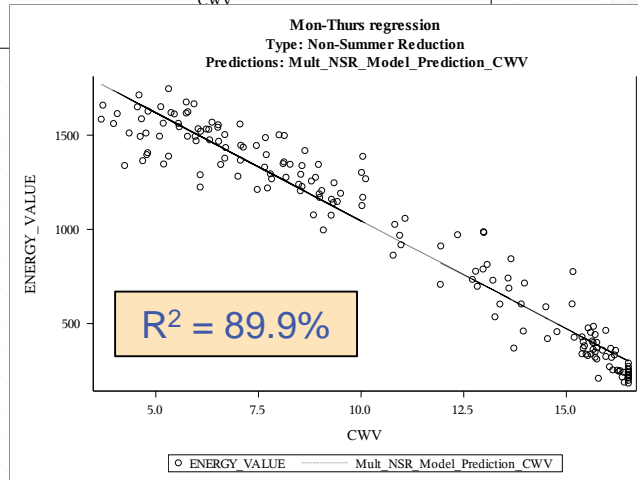
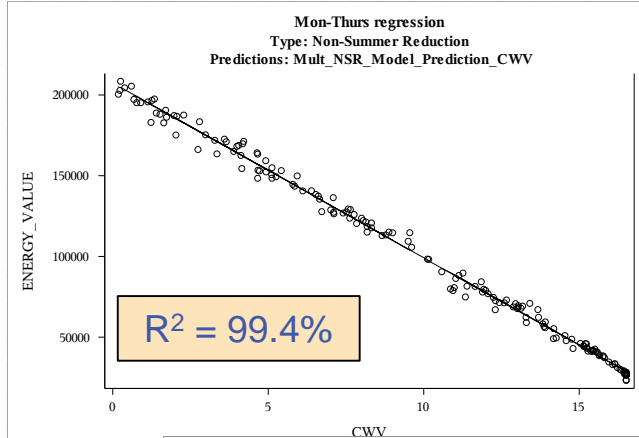
### 3: Modelling Approach – New Gas Demand Modelling System

- In July 2019 DESC agreed the work plan for the Autumn'19 / Winter '20 period. This included the CDSP recommendation to implement upgrades to its modelling processes / systems which produce the key Demand Estimation deliverables
- This work has concluded with a new Gas Demand Modelling system which is now live for the CDSP Demand Estimation team to use and will deliver some of the key requirements set out in the modelling approach, namely: Regression analysis, Smoothing and the Production of Gas Demand Profiles (ALPs, DAFs and PLFs)
- The new system replaces our outdated modelling programmes and software
- The new system offers increased processing capability, greater flexibility and improved insights to the modelling outputs
- The 2020 Gas Demand Modelling will be the first to be performed using the new system

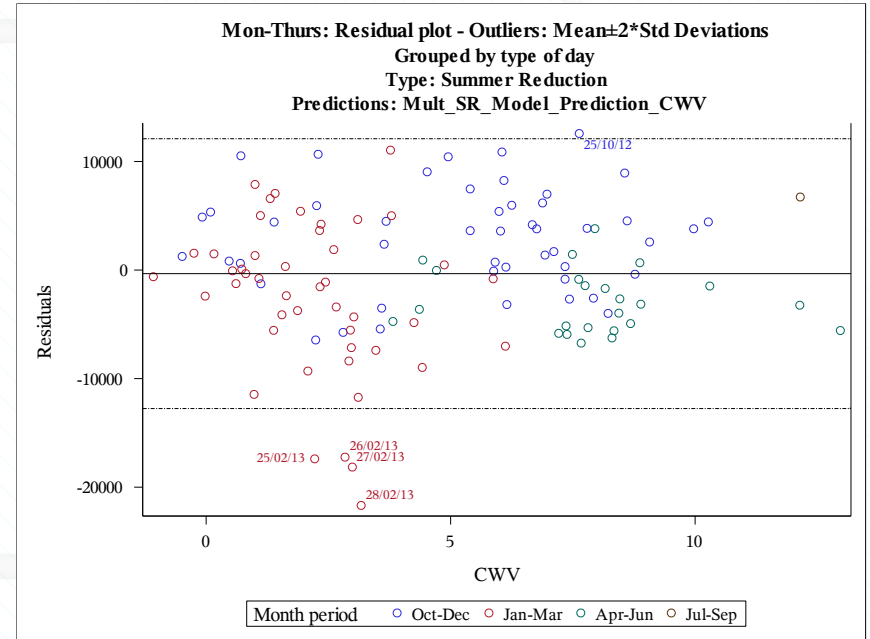
# 4: Measures – What are they?

- 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 best 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

# 4: Measures – R squared Example



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

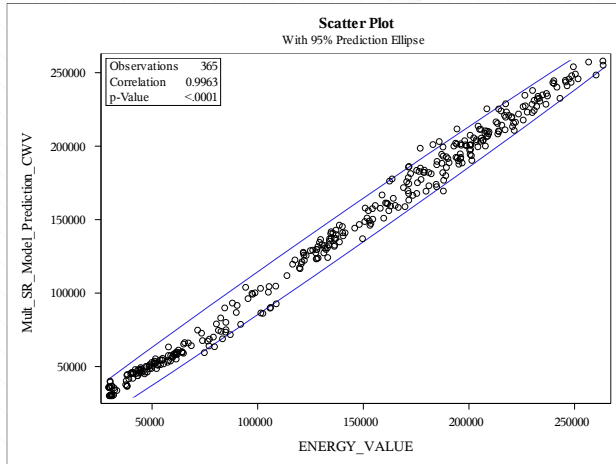


# 4: Measures - Indicative Load Factors (ILFs)

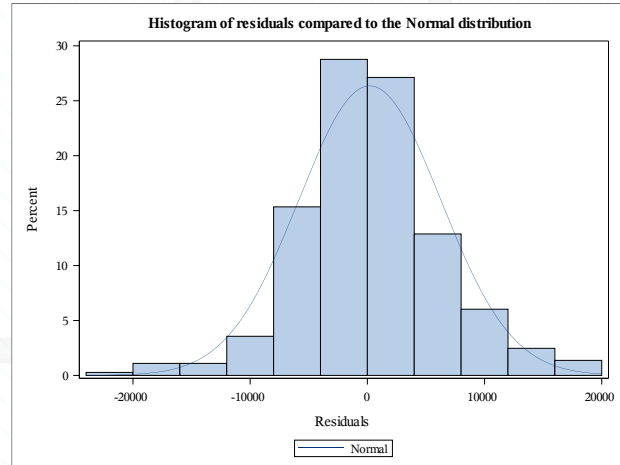
- Indicative Load Factors (ILFs) provide an indication of the weather sensitivity for a Gas Demand Model
- ILFs are only used to compare prospective Gas Demand Models as an aid to making decisions on model choice
- It is expected that there should be distinguishable ILF values between EUC consumption 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:
  - $PLF = \text{average daily demand (i.e. } AQ/365) / 1 \text{ in } 20 \text{ peak demand}$
  - $ILF = (AQ/365) / \text{model demand corresponding to } 1 \text{ in } 20 \text{ CWV}$

# 4: Measures – Additional Model Summary Insight Example

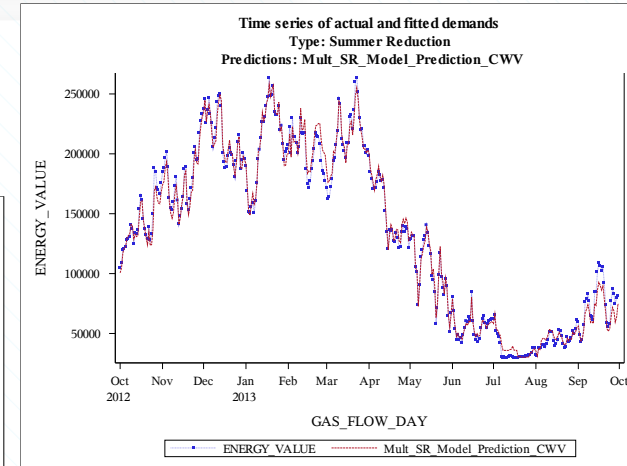
Scatter Correlation Plot  
View of the Actual Demand vs Fitted Demand correlation



Residuals Histogram  
Assessment of residuals compared to Normal distribution



Time Series of Actual & Fitted Demands  
Time series of model performance

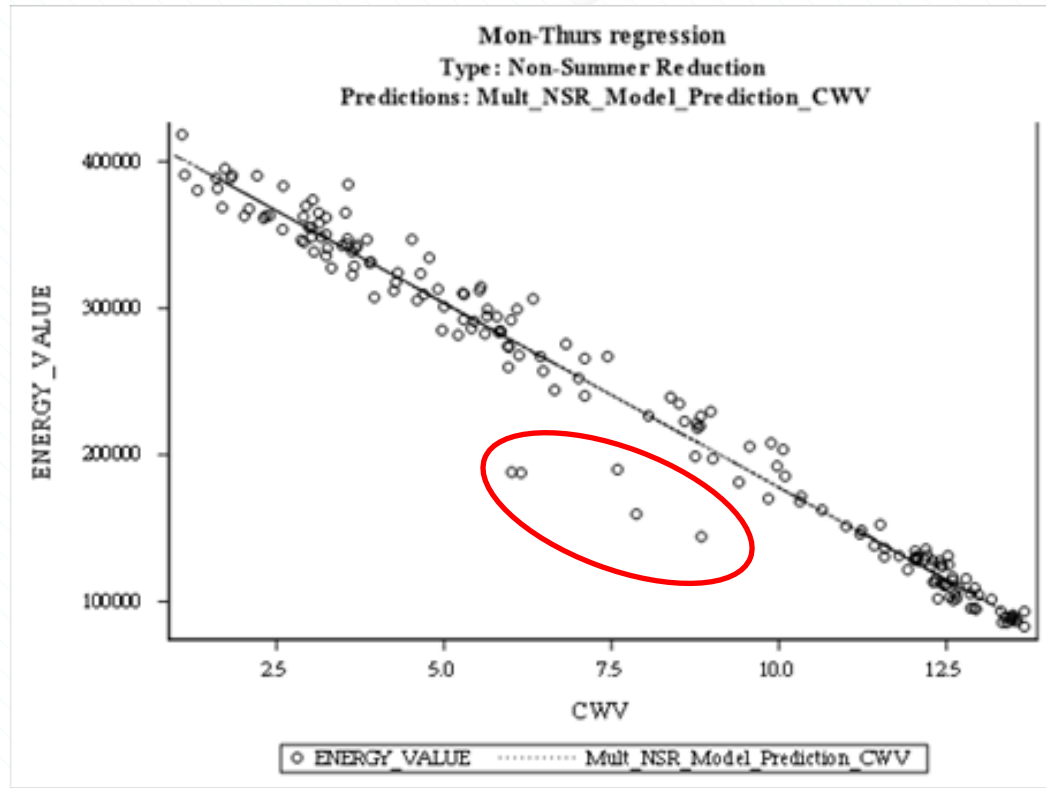


# 5: Impacts of Covid-19 (1)

- The analysis period considered for this years modelling is 1st April 2019 to 31st March 2020
- The Gas Demand Modelling runs agreed by TWG were executed using the new modelling system
- Investigation identified a significant number of 'model outliers' were present within the data for the I&C EUC models. The majority of these outliers covered the last week of March 2020 (see charts on next few slides)
- Government announced strict Covid-19 lockdown measures from around 24th March 2020
- Xoserve issued email to TWG recommending removal of gas days 24th to 31st March for all I&C EUCs (including 4<sup>th</sup> and 6<sup>th</sup> April 2019 for some impacted I&C models due to an unusually high number of missing consumptions which had to be infilled)
- One TWG representative replied in support of this approach and no objections were received
- Therefore main modelling results presented in section 6 DO NOT include the excluded gas days at the end of March (i.e. 24<sup>th</sup> to 31<sup>st</sup> March inclusive)
- Also, in future meetings DESC/TWG will need to consider impacts of Covid-19 affected data on any future analysis – i.e. Algorithm Performance for Gas Year 2019/20 and Gas Demand Modelling in 2021 (for Apr'20 to Mar'21)

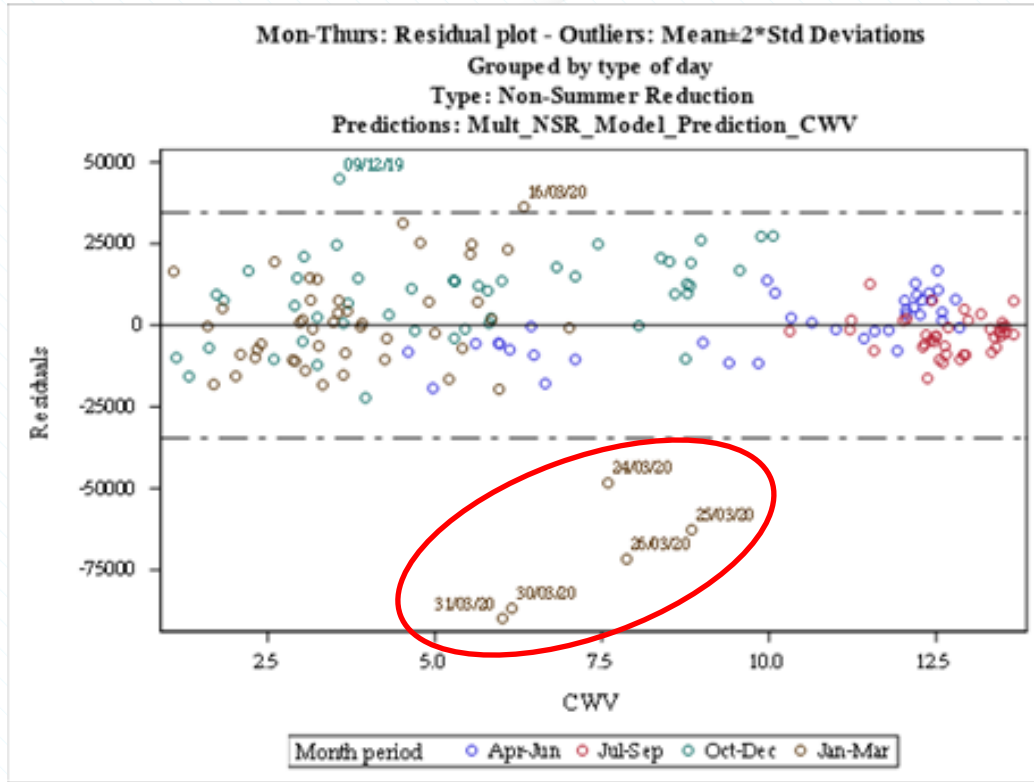


## 5: Impacts of Covid-19 (2)



- Chart represents EUC '03B LDZ NO'
- The majority of outliers circled relate to days affected by Covid-19
- This is typical of results observed for most I&C EUC models

# 5: Impacts of Covid-19 (3)



- Chart represents EUC '03B LDZ NO'
- The majority of outliers circled relate to days affected by Covid-19
- This is typical of results observed for most I&C EUC models