Demand Estimation Sub Committee

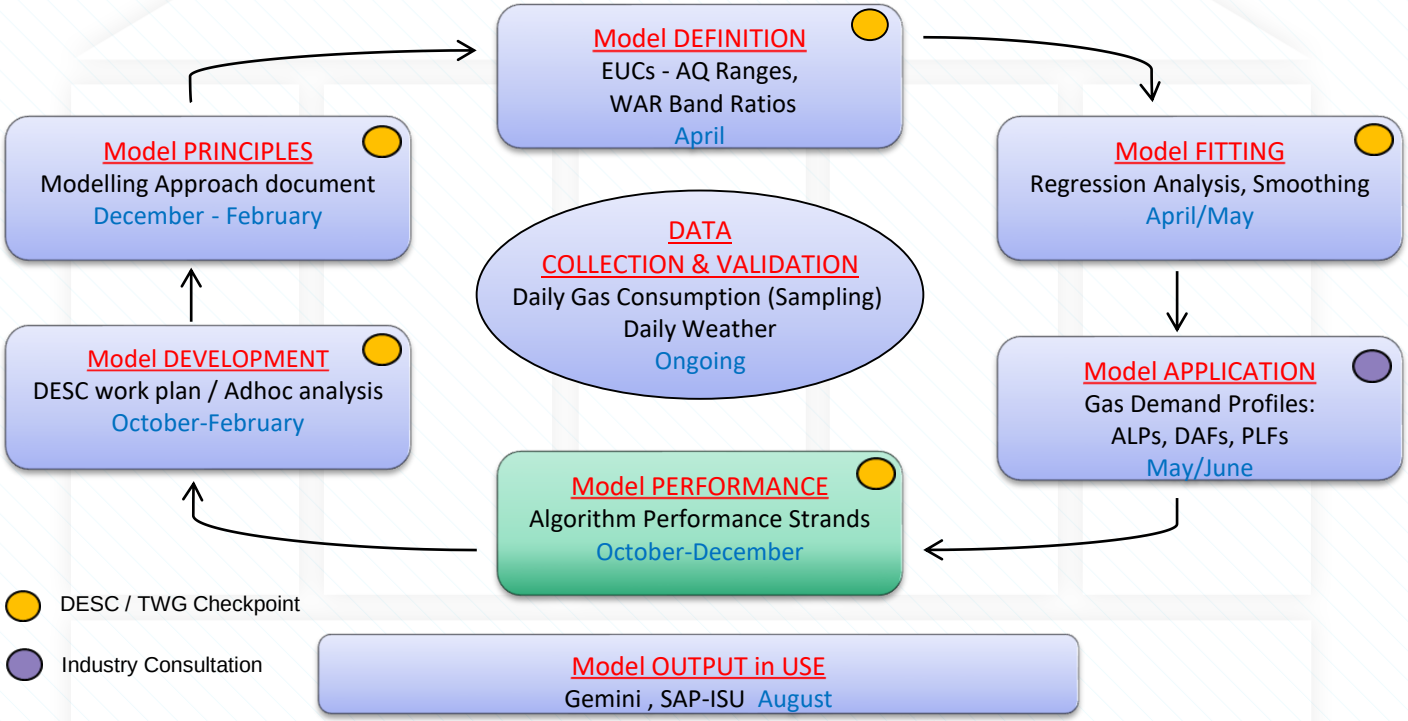
NDM Algorithm Performance (Gas Year 2019/20)

Strand 1 – Weather Analysis

7th December 2020

Overview – Demand Estimation

- An overview of the Demand Estimation process and output can be found here
- This presentation relates to the “Model Performance” phase of the Demand Model cycle



Background

The implementation of Project Nexus on 1st June 2017 introduced a revised NDM demand formula, meaning some of the previous Algorithm Performance measures became redundant

Discussions took place at DESC meetings during the build up to Nexus implementation which concluded on the following strands:

- Strand 1 – Weather Analysis
- Strand 2 – Unidentified Gas Analysis
- Strand 3 – NDM Daily Demand Analysis

Objective of NDM Algorithm Performance

- The purpose of Algorithm Performance is to:
  - Provide confidence in the NDM Supply Meter Point Demand formula
  - Identify possible areas of improvement for future demand modelling

- Where possible, the aim of each analysis strand is to:
  - Provide statistical measures of performance as well as visual representations
  - Develop a more flexible process for Algorithm Performance, allowing us to adapt the data summaries we analyse and how results are presented
  - Carry out ‘regional’ and ‘year on year’ comparisons

- Objective of today’s session is to review Strands 1, 2 & 3

- Supporting document containing full examples and commentary for each strand to be published by end of year

NDM Supply Meter Point Demand Formula

The revised NDM demand formula (effective from 1st June 2017) is shown below:

$$SPD_t = ((AQ/365) \times ALP_t \times (1 + (DAF_t \times WCF_t)))$$

where:
AQ = Annual Quantity
ALP_t = Annual Load Profile
DAF_t = Daily Adjustment Factor
WCF_t = Weather Correction Factor

Further detail on the above parameters can be found in the ‘NDM Demand Estimation Methodology’ document

Strand 1 – Weather Analysis

Background:

- The observed weather conditions on each day and LDZ (expressed as the CWV) influences the NDM gas demand derived by the allocation formula.

Objective:

- Share information on the observed weather conditions for Gas Year 2019/20
- Identify periods of unusual weather throughout the Gas Year which may help give context to further strands of analysis
- Analyse the relationship between aggregated NDM demand and CWV in the complete gas years since parameter optimisation was performed

Notes

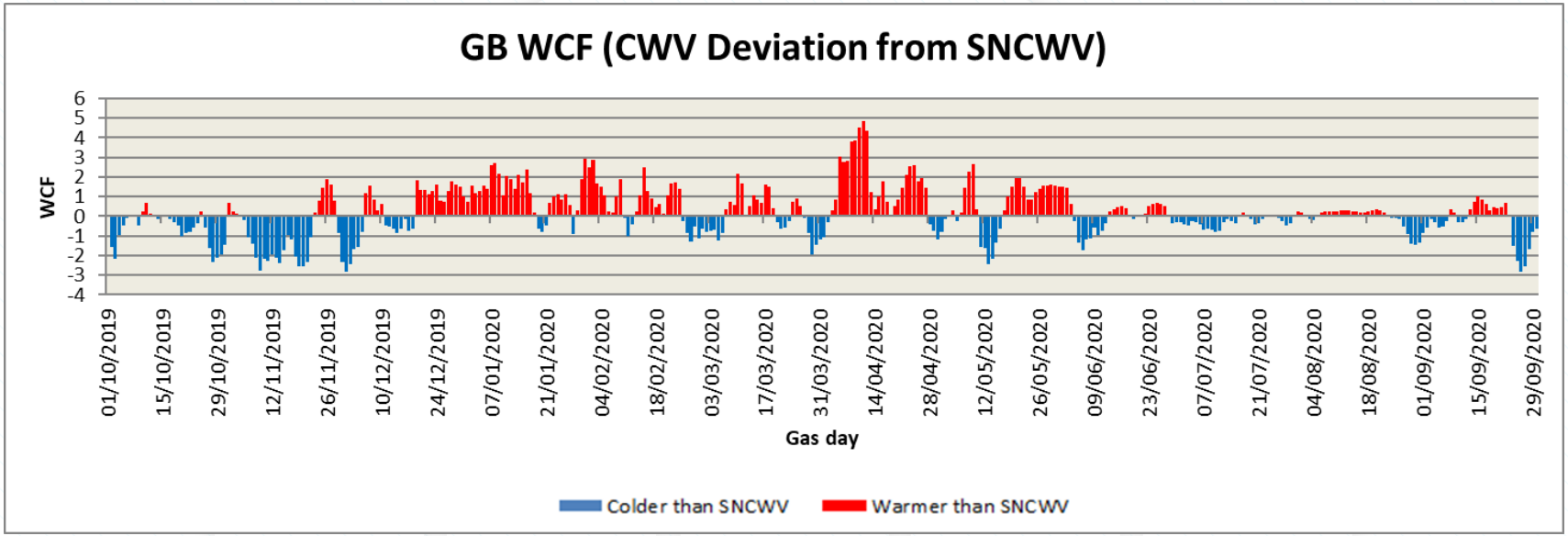
- In order to derive charts/summaries depicting a national view, ‘GB CWV’ and ‘GB SNCWV’ values have been derived using weightings based on NDM throughput

- Weather analysis performed on Gas year 2019/20 has used the ‘old’ version of the Composite Weather Variable which does not include a Solar term, as this was the basis of the CWV at the time.

- During today’s meeting we shall be discussing 3 different Gas Years. Strands 1 to 3 analysis will focus on Gas Year 2019/20

Gas Year 2019/20	Gas Year 2020/21	Gas Year 2021/22

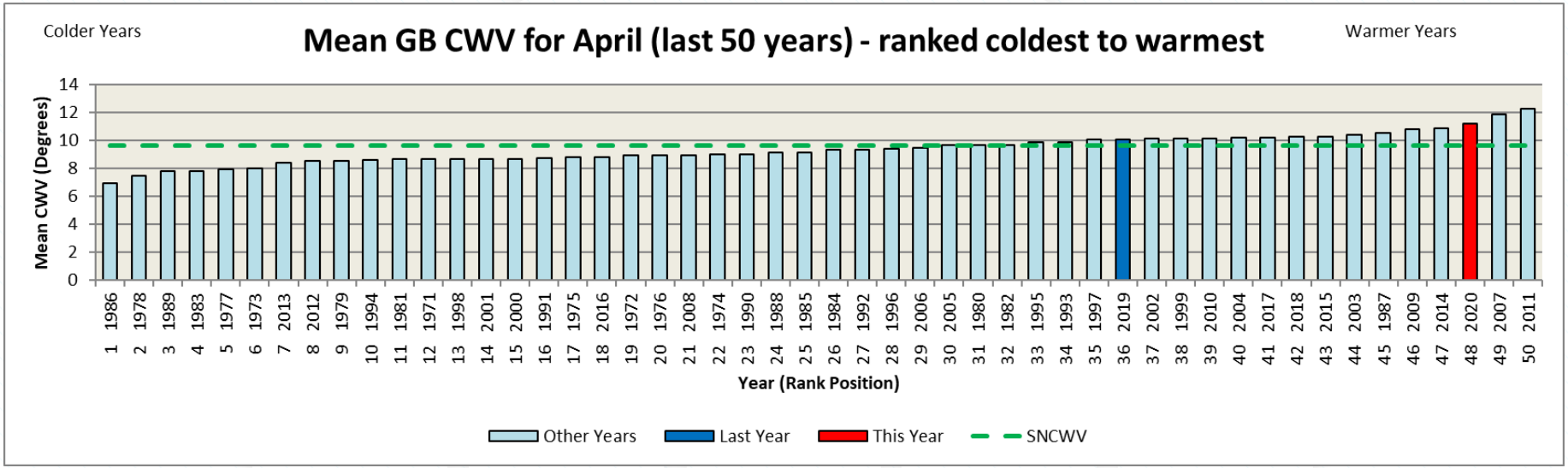
Strand 1 – Weather Analysis: Daily Observations



- Chart shows daily comparisons of CWV vs SNCWV throughout Gas Year 2019/20
- A large deviation from the Seasonal Normal can be observed during April 2020
- Table shows min and max deviation of CWV from SNCWV by month

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Max	+0.70	+1.91	+1.81	+2.95	+2.88	+2.15	+4.87	+2.66	+1.51	+0.24	+0.33	+1.00
Min	-2.32	-2.79	-2.81	-0.89	-1.31	-1.94	-1.19	-2.46	-1.74	-0.81	-1.44	-2.81

Strand 1 – Weather Analysis: Monthly Assessment



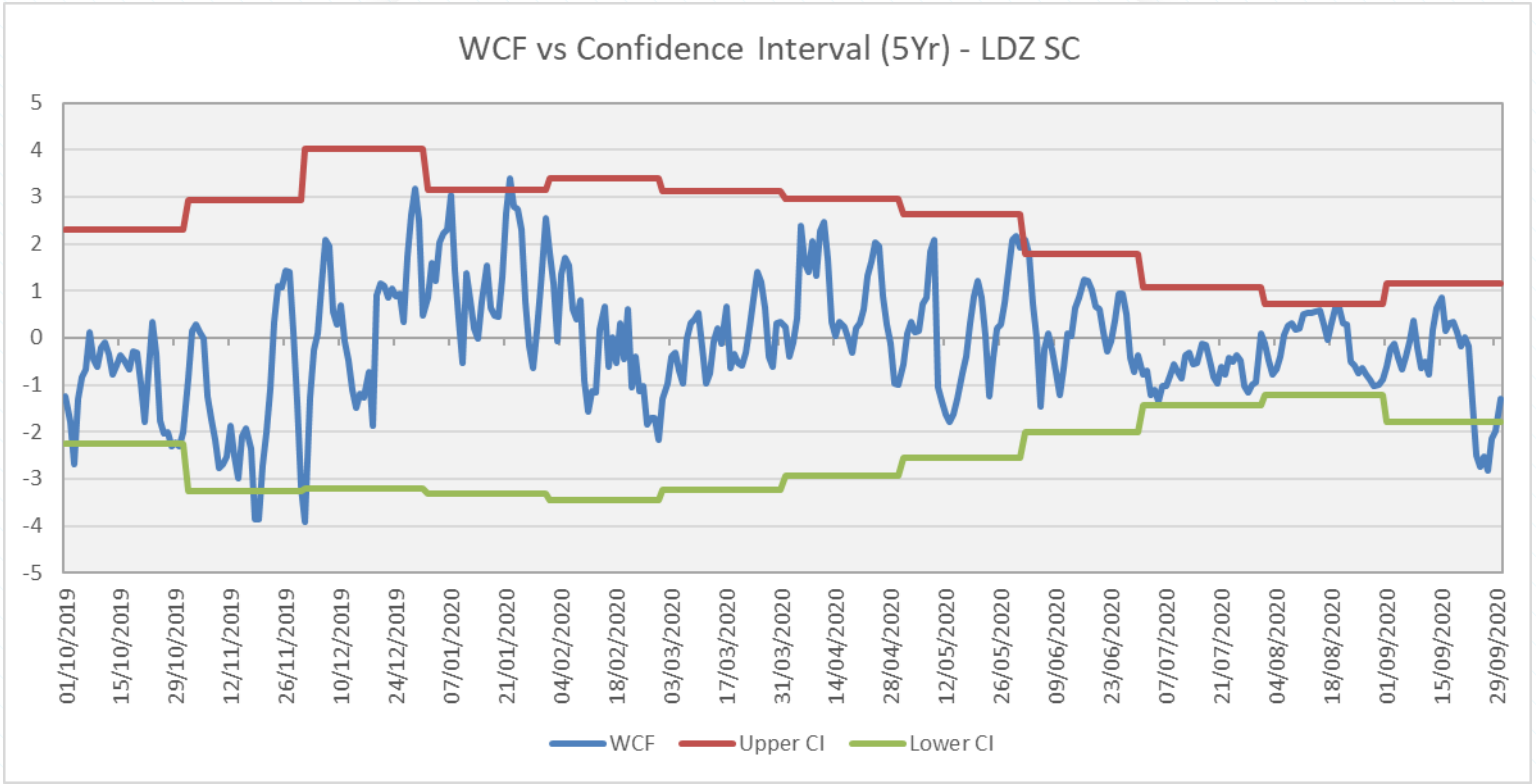
- Chart shows national monthly CWV assessment over past 50 years for April
- April 2020 was much warmer than the seasonal normal basis,
- Ranked as the 3rd warmest April in the previous 50 years

Strand 1 – Weather Analysis: Confidence Interval Analysis

- Confidence Interval analysis has been performed on observed WCF values during Gas Year 2019/20
- The confidence intervals were calculated for each month and LDZ based on 5 years of history (Gas Years 2014/15, 2015/16, 2016/17, 2017/18 & 2018/19)
- An observation is considered unusual if it deviates from the mean
- The 95% CI was calculated by using the mean and standard deviation for the 5 years and we can use these intervals to identify when the WCF is regarded as unusual

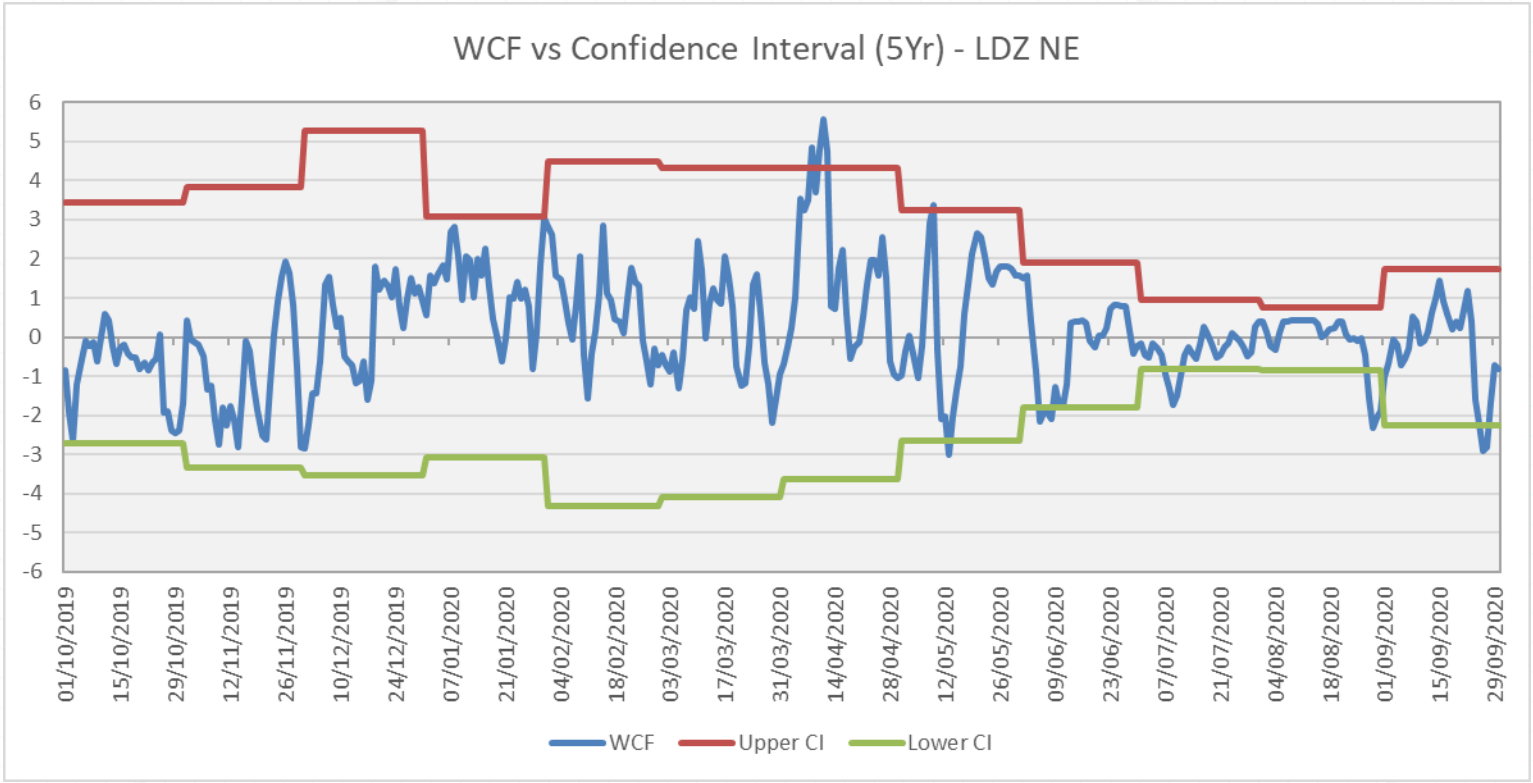
Strand 1 – Weather Analysis: Confidence Interval Analysis

Example chart of LDZ SC where most number of WCF values fall within the confidence intervals



Strand 1 – Weather Analysis: Confidence Interval Analysis

Example chart of LDZ NE where least number of WCF values fall within the confidence intervals



Strand 1 – Weather Analysis: Confidence Intervals Analysis

Month	SC	NO	NW / WN	NE	EM	WM	WS	EA	NT	SE	SO	SW
Oct'19	90%	94%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Nov'19	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Dec'19	97%	97%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Jan'20	97%	97%	97%	100%	100%	100%	100%	97%	100%	100%	100%	97%
Feb'20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Mar'20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Apr'20	100%	97%	93%	87%	87%	83%	77%	87%	87%	87%	87%	83%
May'20	100%	94%	97%	94%	97%	97%	90%	94%	94%	94%	94%	94%
Jun'20	97%	90%	97%	87%	87%	90%	90%	90%	90%	90%	90%	93%
Jul'20	100%	100%	81%	84%	84%	87%	100%	100%	100%	97%	100%	100%
Aug'20	100%	87%	87%	87%	87%	87%	97%	90%	90%	87%	87%	90%
Sep'20	80%	87%	87%	93%	90%	90%	90%	90%	90%	90%	90%	90%

Key: < 95%

- Percentage of WCF values within the confidence interval for each LDZ/Month combination. Where highlighted, 5% or more of Gas days have fallen outside of the Upper or lower Confidence intervals.
- April to September show the most deviation from the average WCF of the past 5 years across all LDZs

Strand 1: Weather Analysis: Conclusions

- Overall, the observed weather during Gas Year 2019/20 when compared to current seasonal normal is as follows:
  - Quarter 1 (Oct'19 to Dec'19) was generally cooler
  - Quarter 2 (Jan'20 to Mar'20) was generally warmer
  - Quarter 3 (Apr'20 to Jun'20) was generally warmer
  - Quarter 4 (Jul'20 to Sep'20) was generally cooler

- The stand out periods of unusual weather were:
  - April'20 – 3rd warmest April in 50 years

- Top 5 colder than Seasonal Normal days:
  - 09th Nov 2019, 19th Nov 2019, 01st Dec 2019, 26th & 27th Sep 2020

- Top 5 warmer than Seasonal Normal days:
  - 08th to 12th April 2020

- When interpreting the various strands of Algorithm Performance, it is relevant to recall the weather conditions that prevailed during the Gas Year being analysed

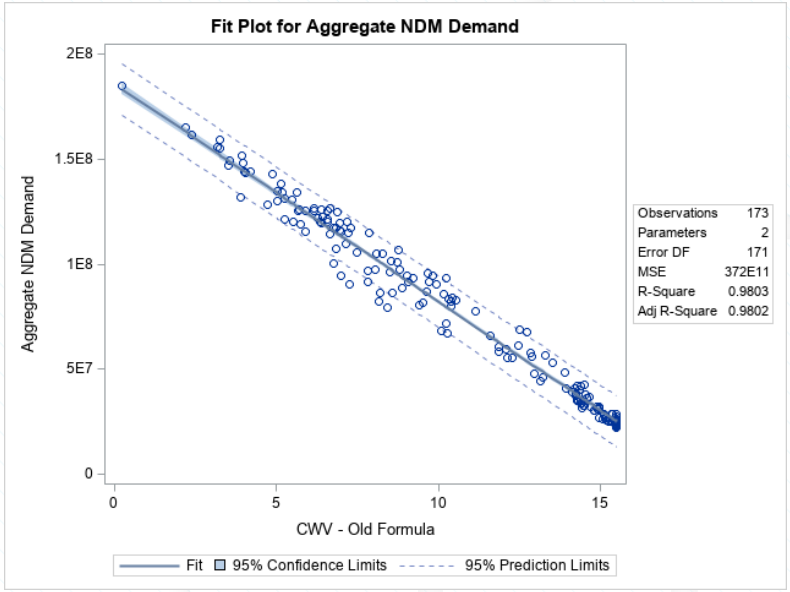
Demand Estimation Sub Committee

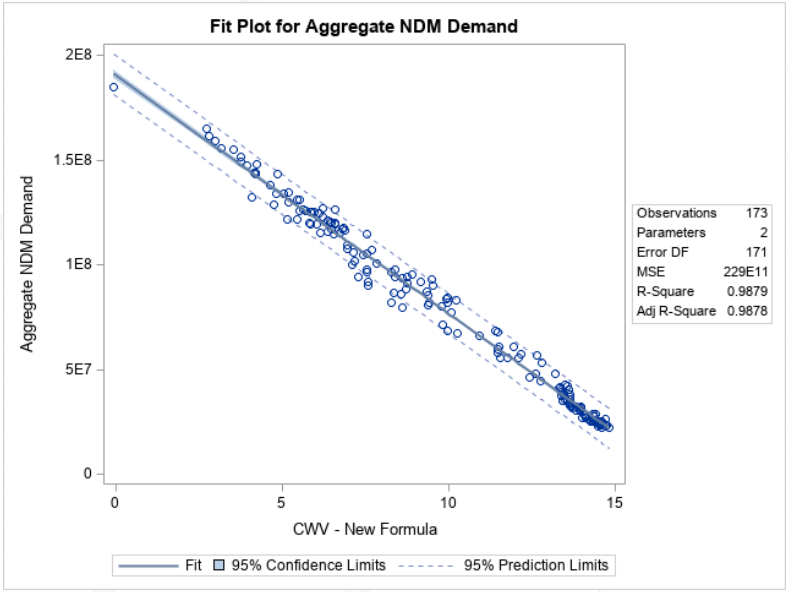
Review of New CWV Formula
Gas Years 2018/19 and 2019/20

Review of New CWV Formula

- During 2019, British Gas DESC members amended the CWV formula and performed optimisation of the CWV parameters including the newly introduced Solar Radiation term
- The goal of optimisation was to produce a set of parameters which, when included in the CWV calculation, produced the best possible relationship between Aggregated NDM Demand (Daily NDM Demand + UIG) and the CWV for all Monday to Thursday Non-Holiday Gas Days
- Optimisation was performed on Gas Years 2010/11 to 2017/18, therefore there have been 2 complete Gas Years since, namely 2018/19 and 2019/20
- The following slides show regression analysis performed on these Gas Years, and a comparison between the two weather basis'

Review of New CWV Formula – Gas Year 2018/19





- The charts above show an example of the regression analysis performed on LDZ SW for all Monday to Thursday Non-holiday Gas Days in Gas Year 2018/19

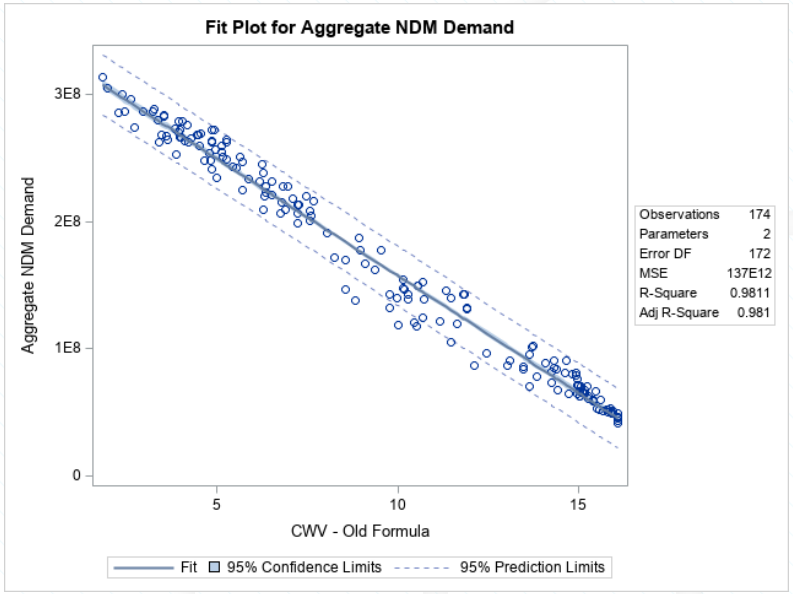
- The R^2 value using the new CWV formula was 0.9879, an improvement of 0.0076 from the previous CWV formula which had an R^2 value of 0.9803. A 'closer fit' of the data points can be also be observed

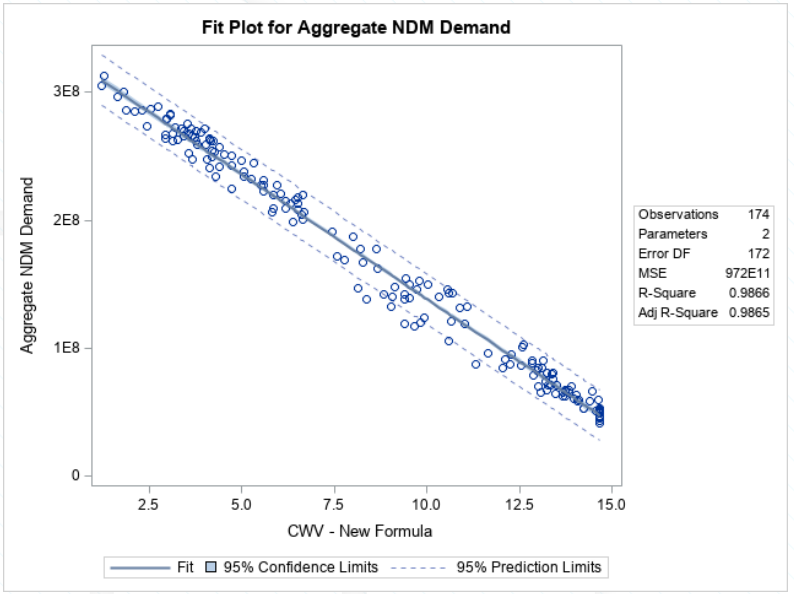
Review of New CWV Formula – Gas Year 2018/19

Gas Year 2018/19			
LDZ	Old Formula	New Formula	Difference
EA	0.9933	0.9938	0.0005
EM	0.9910	0.9938	0.0028
NE	0.9874	0.9896	0.0022
NO	0.9835	0.9880	0.0045
NT	0.9951	0.9955	0.0004
NW	0.9792	0.9855	0.0063
SC	0.9889	0.9888	-0.0001
SE	0.9935	0.9941	0.0006
SO	0.9912	0.9919	0.0007
SW	0.9803	0.9879	0.0076
WM	0.9902	0.9937	0.0035
WN	0.9755	0.9782	0.0027
WS	0.9806	0.9850	0.0044

- Under the new CWV definition, 12 of 13 LDZs saw an improvement in the relationship between aggregate NDM demand and CWV in Gas Year 2018/19
- SC was the only LDZ which saw a very minor decrease when moving to the new CWV formula

Review of New CWV Formula – Gas Year 2019/20





- The charts below show an example of the regression analysis performed on LDZ NW for all Monday to Thursday Non-holiday Gas Days in Gas Year 2019/20

- The R^2 value using the new CWV formula was 0.9866, an improvement of 0.0055 from the previous weather basis which had an R^2 value of 0.9811. A 'closer fit' of the data points can be also be observed

Review of New CWV Formula – Gas Year 2019/20

Gas Year 2019/20			
LDZ	Old Formula	New Formula	Difference
EA	0.9900	0.9893	-0.0007
EM	0.9843	0.9866	0.0023
NE	0.9768	0.9801	0.0033
NO	0.9808	0.9843	0.0035
NT	0.9927	0.9924	-0.0003
NW	0.9811	0.9866	0.0055
SC	0.9873	0.9880	0.0007
SE	0.9915	0.9927	0.0012
SO	0.9888	0.9891	0.0003
SW	0.9799	0.9847	0.0048
WM	0.9862	0.9903	0.0041
WN	0.9772	0.9804	0.0032
WS	0.9734	0.9775	0.0041

- Under the new CWV definition, 11 of 13 LDZs saw an improvement in the relationship between aggregate NDM demand and CWV in Gas Year 2019/20
- 2 LDZs (EA and NT) saw a very minor decrease of 0.0007 and 0.0003 respectively

Review of New CWV Formula – Conclusions

- Overall, there has been an improvement in relationship between aggregated NDM Demand and CWV in Gas Years 2018/19 and 2019/20 when moving to the new weather basis

- It is reassuring to see that the new formula and optimised parameters continue to provide an improved relationship to gas demand