Demand Estimation Sub Committee

3.0 Seasonal Normal Review 2025

24 April 2024

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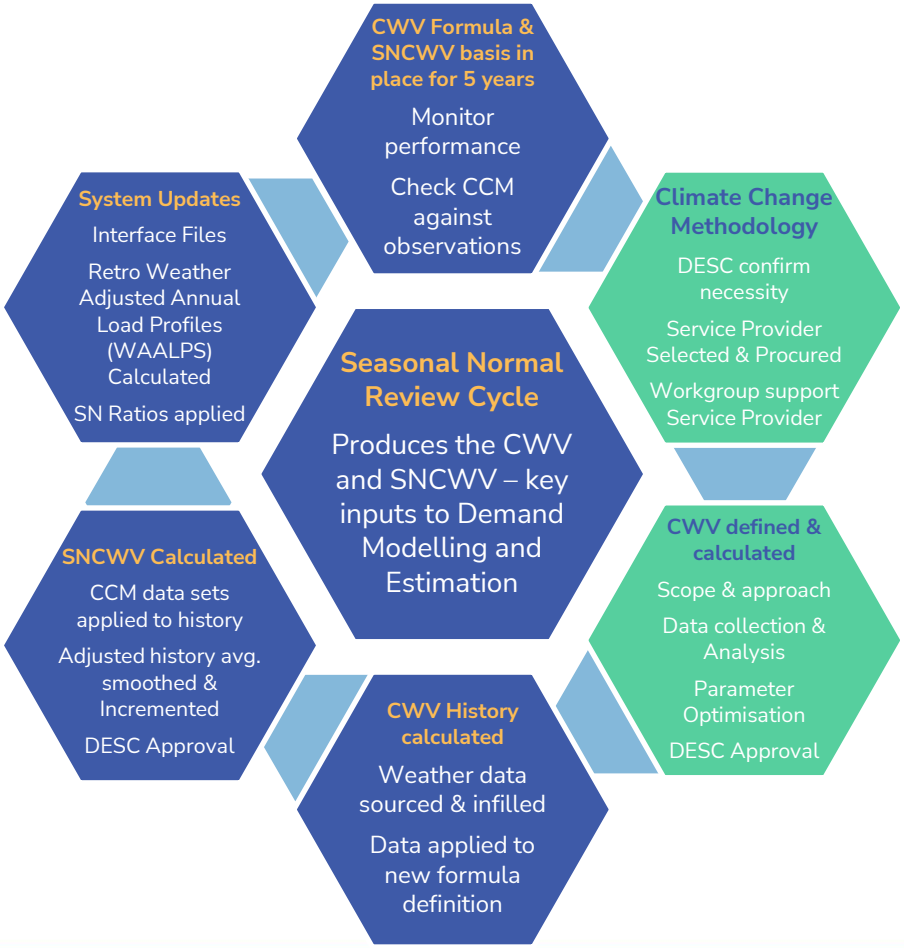
- Composite Weather Variable (CWV) Formula review
  - Update on CWV formula optimisation
- Seasonal Normal Composite Weather Variable (SNCWV) review
  - Update on Climate Change Methodology

Background

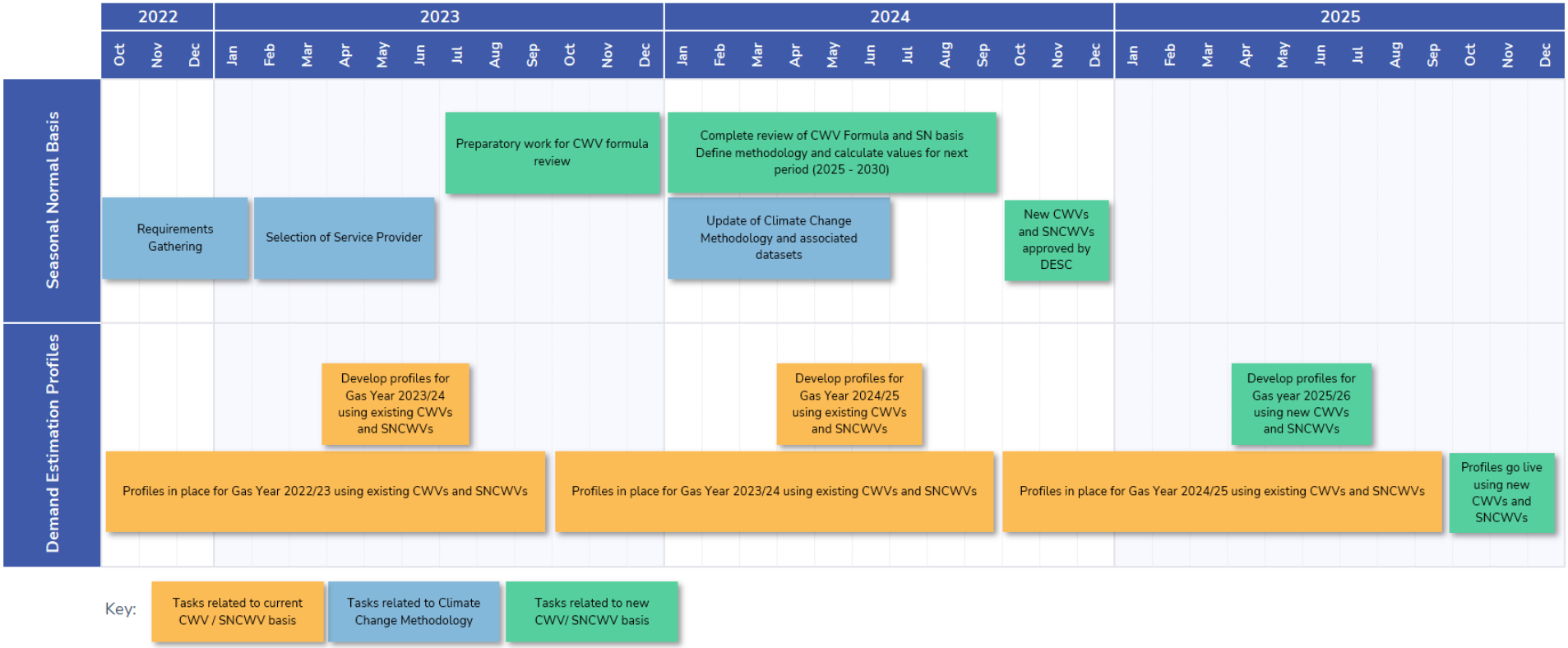
- DESC are responsible for a number of obligations in Section H of UNC, amongst them are the requirements to:
  - Review the Composite Weather Variable (CWV) (H 1.4.3) and
  - Review the Seasonal Normal equivalent referred to as the SNCWV (H 1.5.3)
- Reviews of the CWV formula and Seasonal Normal basis are normally only carried out by DESC every 5 years due to the time taken to perform the review and the need for stability
- The latest DESC review in 2019 derived a new CWV formula and new basis for the Seasonal Normal, which both came into effect from the 01 October 2020
- This means the next Seasonal Normal basis is scheduled to take effect from 01 October 2025 with the detailed analysis performed during 2024

Seasonal Normal Review

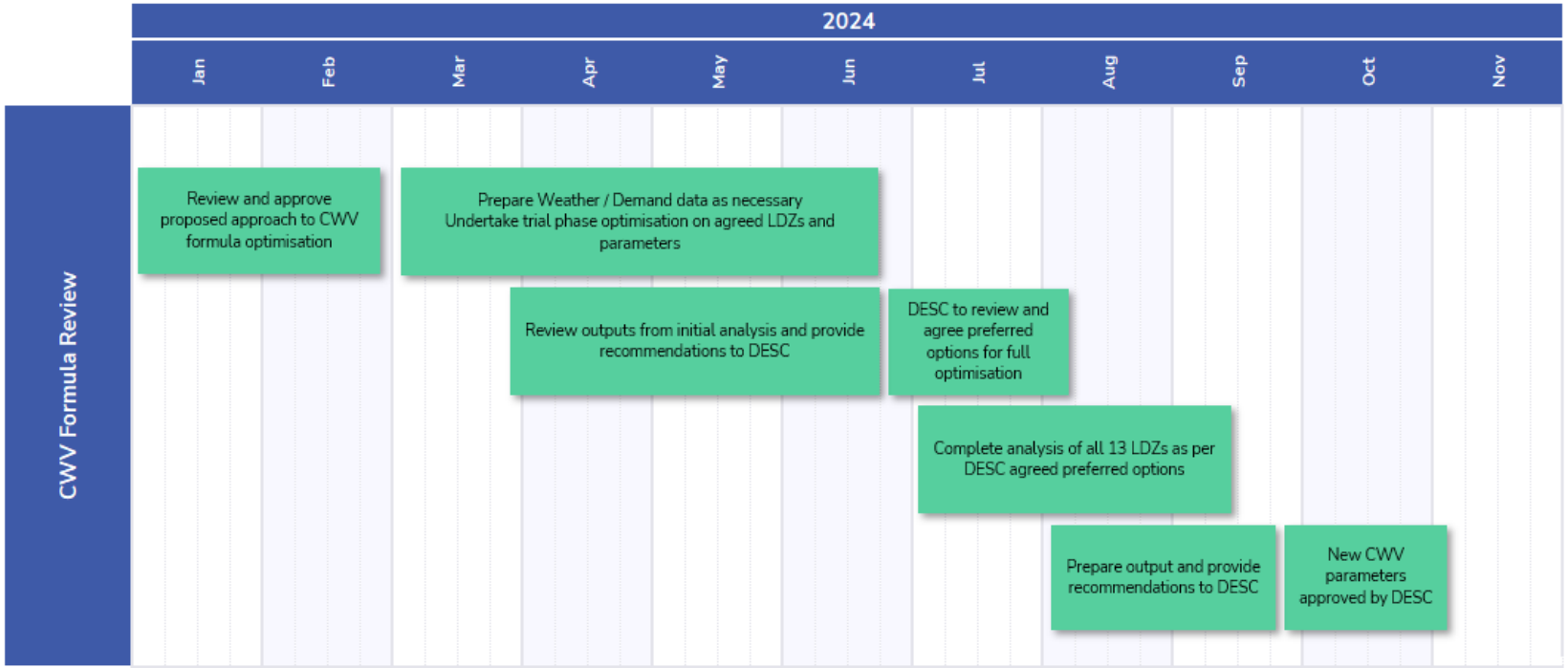


- An overview of the Demand Estimation process and output can be found here
- Composite Weather Variable (CWV) and Seasonal Normal CWV (SNCWV) are key inputs to the Demand estimation process
- Seasonal Normal Review (SNR) cycle, undertaken at minimum once every 5 years, represented in diagram opposite
- This presentation relates to updates on the **Climate Change Methodology (CCM)** and **CWV definition** phase of the SNR cycle

High level Timeline



CWV Optimisation Timeline



- The above outlines the tasks to be undertaking during the trial and productions phases of CWV formula optimisation, with final approval to be sought from DESC at 8 October 2024 meeting

Objectives

- Provide an update on the CWV formula review including exploratory analysis of the current CWV formula.

- Provide an update on next steps of Seasonal Normal Review, focusing on a recent TWG meeting with the Met Office to discuss the refresh of the Climate Change Methodology (CCM).

3.0 Seasonal Normal Review

UPDATE ON CWV FORMULA REVIEW

Approach

- DESC agreed the approach to the review of the CWV formula at it's meeting in January 2024.

- The scope of the review will cover an optimisation of the parameters used within the CWV formula, and will not consider any fundamental changes to the formula, such as introducing a new weather variable, or additional terms within the formula

- Some initial analysis has been performed on the current CWV, including 'day to day' change in CWV and Temperature, Cold Weather Upturn, and Summer Cut-Off transition phases (see next slide) to gather any insight which may be useful during the trial and production phases of parameter optimisation

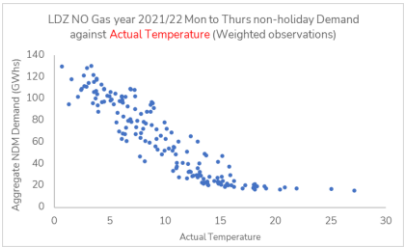
Reminder - CWV Formula Overview

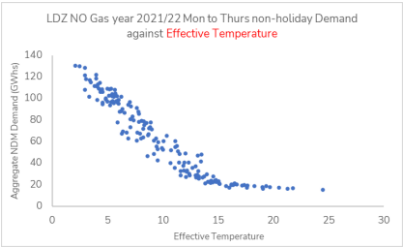
Reminder of the CWV formula (below) and parameters (bottom left) which are designed to provide a linear fit to gas demand (bottom right).

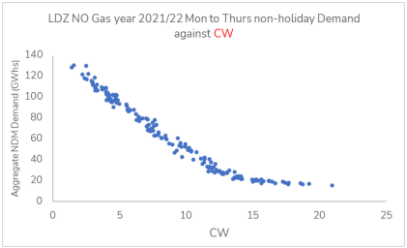
$$\mathbf{CW_t = I_1 * E_t + (1.0 - I_1) * S_t - I_2 * Max(0, W_t - W_0) * Max(0, T_0 - AT_t) + S_0 * SR_t + P_0 * P_t}$$

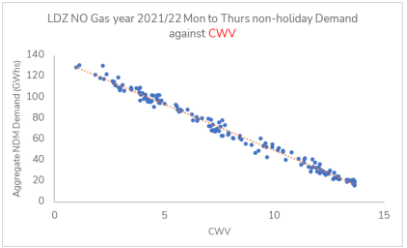
$\mathbf{CWV_t = V1 + q * (V2 - V1)}$	if $\mathbf{V_2 \leq CW_t}$	(summer cut-off)
$\mathbf{CWV_t = V1 + q * (CWt - V1)}$	if $\mathbf{V_1 < CWt < V2}$	(transition)
$\mathbf{CWV_t = CWt}$	if $\mathbf{V_0 \leq CWt \leq V1}$	(normal)
$\mathbf{CWV_t = CWt + I3 * (CWt - V0)}$	if $\mathbf{V_0 > CWt}$	(cold weather upturn)

LDZ	y	I1	I2	I3	V0	V1	V2	q	W0	T0	S0
SC	0.505	0.680	0.011	0.000	1.053	12.590	16.402	0.509	-2.992	15.476	0.507
NO	0.492	0.646	0.008	0.126	5.000	12.005	15.779	0.438	-0.894	16.657	0.950
NW	0.498	0.646	0.009	0.315	2.694	12.775	16.466	0.513	-5.000	21.312	0.802
NE	0.459	0.672	0.009	0.083	-1.261	12.924	16.679	0.446	-1.652	21.596	0.568
EM	0.480	0.689	0.010	0.138	-1.344	13.008	16.897	0.424	-2.417	17.377	0.698
WM	0.471	0.692	0.010	0.163	4.385	13.392	17.480	0.368	-3.619	17.569	0.678
WN	0.482	0.618	0.009	0.324	3.773	13.477	16.987	0.445	-3.926	18.249	0.679
WS	0.543	0.657	0.008	0.079	1.797	13.826	17.186	0.384	-1.910	17.068	0.776
EA	0.460	0.723	0.015	0.109	-0.235	15.131	18.885	0.368	-0.477	12.650	0.635
NT	0.473	0.715	0.015	0.066	4.898	15.029	19.184	0.429	-3.811	12.833	0.695
SE	0.484	0.772	0.006	0.266	1.335	13.996	18.523	0.375	-0.721	21.613	0.566
SO	0.438	0.692	0.015	0.405	0.141	14.745	18.715	0.345	-2.076	11.978	0.559
SW	0.448	0.623	0.008	0.258	3.476	13.254	17.898	0.337	0.705	21.707	0.801









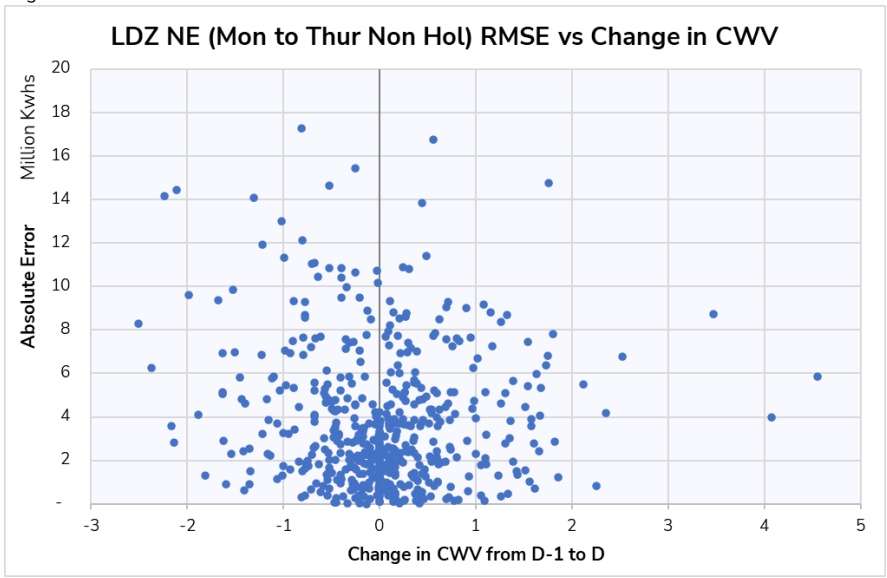
Analysis – Change in CWV

- Exploratory analysis has been performed to see if there is a clear pattern of worse performance in the CWV formula on Gas days where CWV has changed markedly from the previous Gas Day.

- Fig.1 shows daily change in CWV plotted against absolute error from the linear regression between CWV and Aggregate NDM Demand for all Mon to Thurs non-holiday Gas Days in Gas Years 2020/21 to 2022/23 for LDZ NE.

- There is no clear indication of worsening error terms when day to day change in CWV increases. Example provided is for LDZ NE, however this is typical of all LDZs.

Fig.1



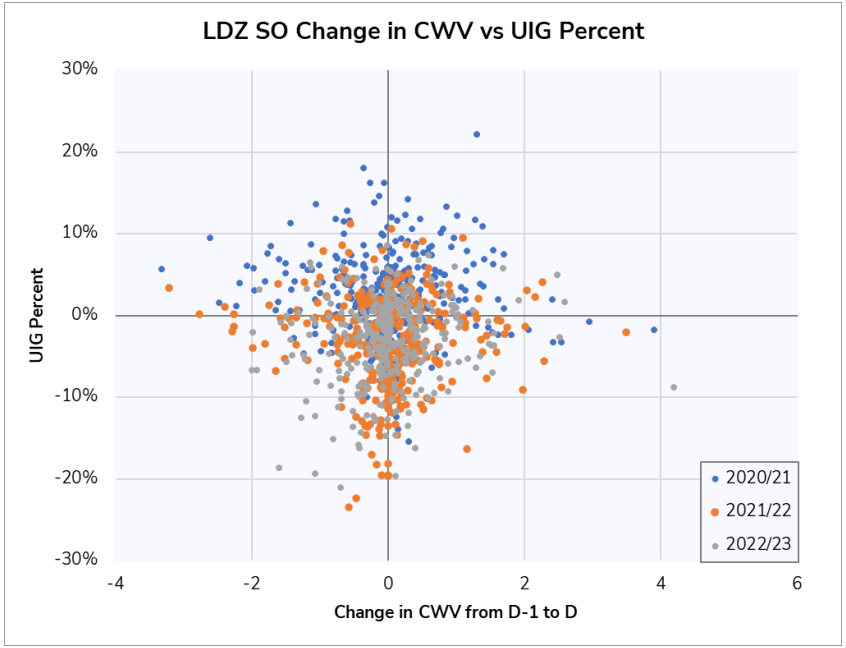
Analysis – Change in CWV

- Fig.2 shows the daily change in CWV from D-1 to D against UIG Percentage for LDZ SO Gas Years 2020/21 to 2022/23. There is no clear indicator that UIG percentages worsen as change in daily CWV increases. LDZ SO is shown, however this is typical of all LDZs.

- For the 3 Gas Years analysed, where CWV change was between ±1.00, UIG percentage had an average of -1.46% with a standard deviation of 5.86%. Where change in CWV was greater than ±1.00, UIG percentage had an average of 0.24% and standard deviation of 5.69%.

- Change in CWV can be mitigated in the formula by Effective Temperature (see next slide).

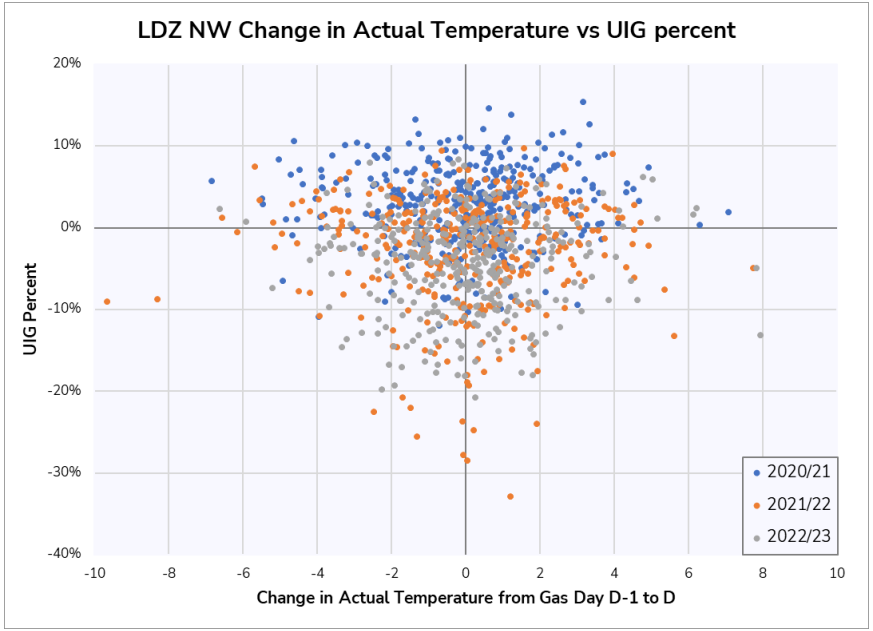
Fig.2



Analysis – Change in Daily Temperature

- Fig.3 shows the daily change in Actual Temperature (AT) against UIG Percentage for LDZ NW Gas Years 2020/21 to 2022/23. There is no clear indicator that UIG percentages worsen as change in daily temperatures increases, NW is shown, however this is typical of all LDZs.

Fig.3



- Effective Temperature for a given Gas Day 'D' is calculated as below, with parameter 'y' governing the weighting applied to Effective Temperature for D-1 and Actual Temperature for Gas Day t.

$$ET_D = y * ET_{D-1} + (1 - y) * AT_D$$

- The value of parameter y allows the formula to increase or decrease more or less rapidly in reaction to changes in Temperature from Gas Day D-1 to D. During Optimisation 'y' will be allowed to 'flex' between 0 (i. e. ET_D is entirely based on daily Actual Temperature) and 1 (i.e. ET_D is based entirely on previous days Effective Temperature).

Analysis - Cold Weather Upturn

- Figs 4. and 5. show unadjusted CWs in the 'Cold weather upturn' Transition phase for LDZs NO (cold weather upturn V0 = 5.000) and WM (V0 = 4.385) respectively.

- NO and WM have some of the highest cold weather upturn thresholds of all LDZs hence the most data points.

- Across each Gas Year, the data points which fall below V0 in the initial CW calculation are showing a good linear relationship, with a high R^2 value, to Aggregate NDM Demand. The R^2 values suggest that the linear adjustment to the cold weather upturn is still appropriate.

- The magnitude of the linear adjustment (I3) will be analysed for each LDZ during optimisation.

Fig.4

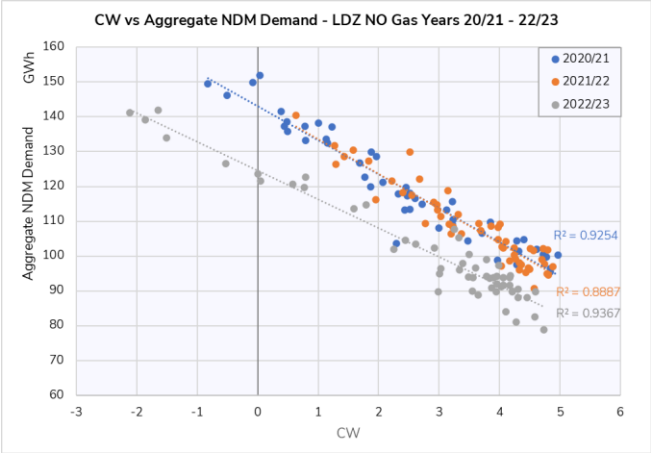
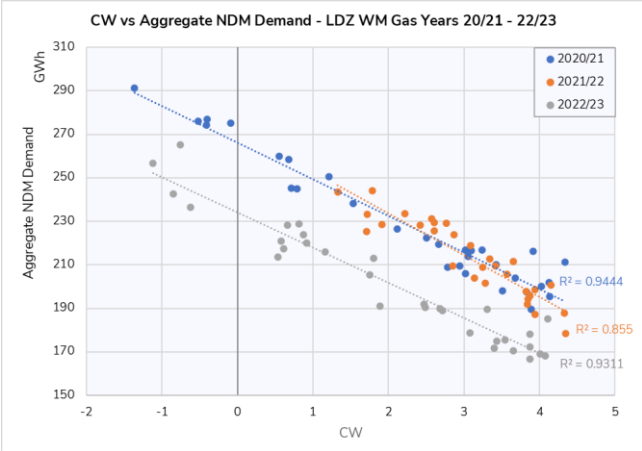


Fig.5



Analysis – Summer Cut-Offs

- Fig.6 shows LDZ WS (Summer cut-off parameter V2 = 17.186). No clear pattern is evident in instances where CW is greater than the Summer cut off, R^2 values are very low indicating a poor relationship between weather and demand after this point i.e. 'flattening of demands'

- Fig. 7 shows LDZ SE (V2 = 18.523). The downward trend in demand, and higher R^2 indicates there is some evidence that demand still decreases after the Summer cut-off, particularly in Gas Years 2020/21 and 2021/22. This could be an indication that the cut-off in SE could be too low.

- Moving the Summer cut offs would see more days fall into the 'Transition' phase between 'Normal' and 'Cut-off', which could worsen that relationship. Priority is to improve relationship on cooler days where overall demand is higher.

Fig.6

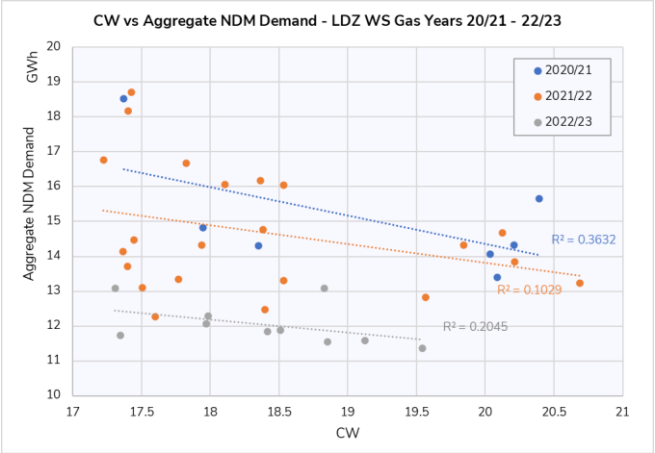
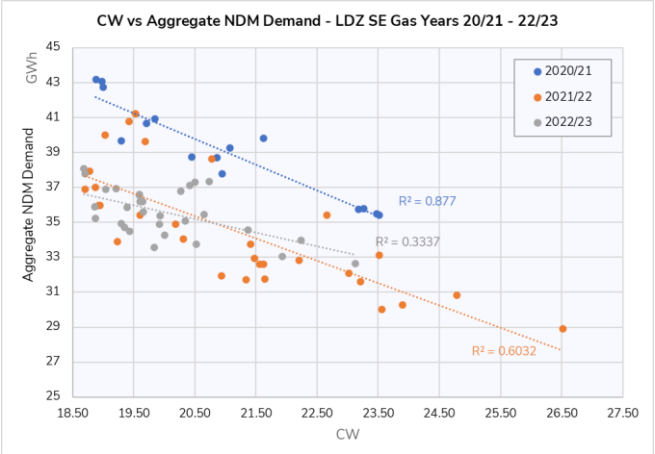


Fig.7



Conclusions

- There is no clear indicator that larger changes in daily CWV or Actual temperature correlate with worsening UIG or performance in CWV vs Aggregated NDM Demand. Parameter Optimisation will allow the Effective Temperature to mitigate any underlying patterns not currently picked up by the CWV formula.

- A linear ‘Cold Weather Upturn’ appears to be an appropriate fit when assessed for LDZs which have a higher Upturn threshold and greater of number days within the Cold Weather Upturn. Cold weather thresholds and magnitude of upturns will be optimised for all LDZs.

- There are some indications of continued demand reduction past the Summer Cut off in select LDZs which will be assessed further during the Trial and Production optimisation phases, however caution will be taken to ensure the Cut Offs are at a suitable point for all transition phases of CW.

- Reminder: All parameters are optimised to provide the best fit on average between CWV and Aggregate NDM demand over the selected 8-year period, improvements across winter months and shoulder periods are treated preferentially due to higher demands at those times.

3.0 Seasonal Normal Review

UPDATE ON CLIMATE CHANGE METHODOLOGY (CCM)

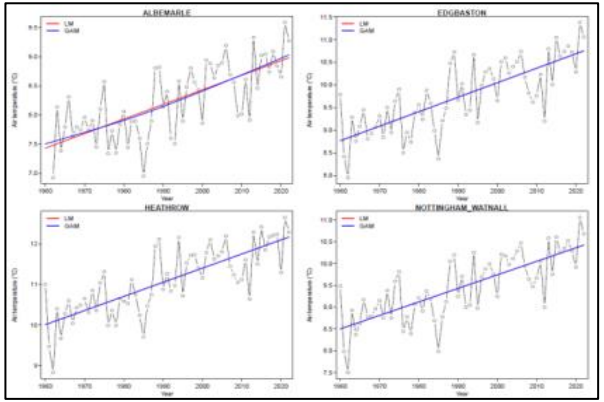
Update on CCM (1 of 3)

- DESC Technical Workgroup (TWG) had a follow up meeting with Met Office on 05 April 2024 where a progress update was given on the Climate Change Methodology refresh (which will be used as an input to the new Seasonal Normal basis). Headline updates are covered here:

- In previous CCM, only Temperature was adjusted due to the clear underlying trend of climate change. For this CCM it is expected that all variables' histories will be adjusted to account for climate change and/or any location/ equipment changes.

- Temperature continues to be a linear upward trend (Fig.1) attributed to greenhouse gas emissions, Temperature is expected to be adjusted using similar methodology as previous CCM i.e. Linear adjustment.

Fig.1 Example of Temperature trends



Courtesy Met Office

Update on CCM (2 of 3)

- A negative trend in Windspeed is observed (Fig.2). Adjustments due to station changes and equipment changes may be required.
- A positive trend in Solar Radiation is observed (Fig.3) due to reduction in aerosol emissions,
- No clear signal is apparent in long term trends in Precipitation (Fig.4).

Fig.2 Example of Windspeed trends

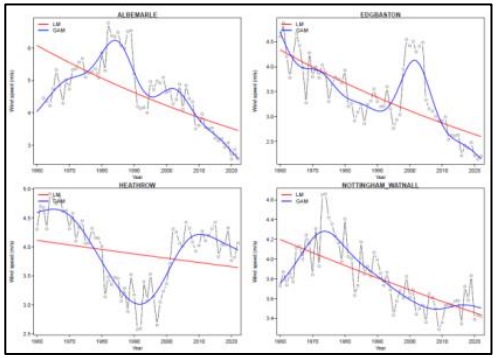


Fig.3 Example of Solar Radiation trends

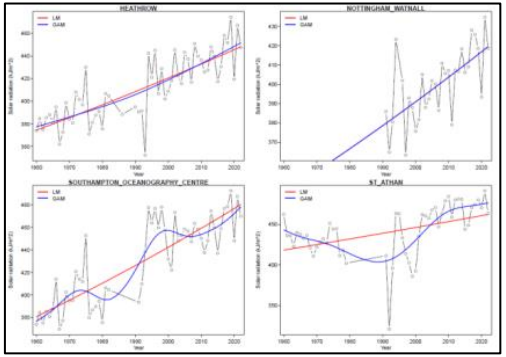
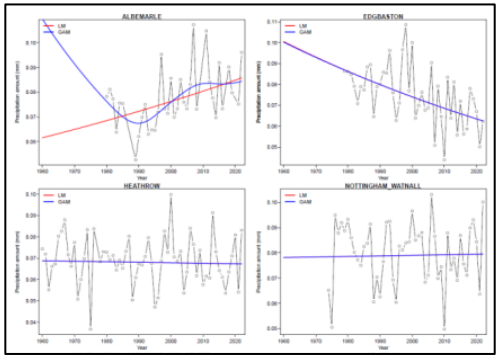


Fig.4 Example of Precipitation trends



Figures courtesy Met Office

- Relative Humidity is expected to be adjusted using a linear trend, and no trends are expected in Wind Direction. Met Office expect to deliver both optional variables.

Update on CCM (3 of 3)

- Met Office have proposed a change in the climatology approach – previous increments were based on a prediction of weather, meaning they were ‘noisy’ and had the potential to ‘double count’ when added to observed colder or warmer weather events.

- The proposal for projections and increments is to base them on a smoothed climatological prediction to produce a smoother set of outputs. (Figs. 1&2)

- Future projections in this CCM will be created using UKCP18 probabilistic projections, which combine bias corrected projections from a suite of Met Office international models using a sophisticated Bayesian methodology to capture widest range of plausible outcomes.

- Met Office are on track to deliver by end of Q2 2024, with the next progress meeting likely to be a run-through of the first draft of final report, followed by a period of review.

Fig.5 – Previous increments

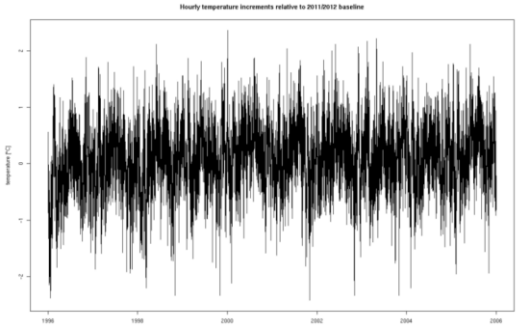
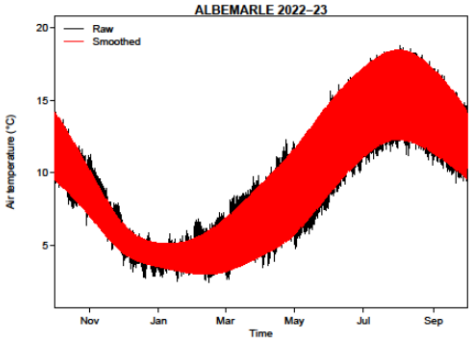


Fig.6 – Smoothed Projections for a single year



Note: Figures are based on preliminary data and adjustments are yet to be finalised. Courtesy Met Office.

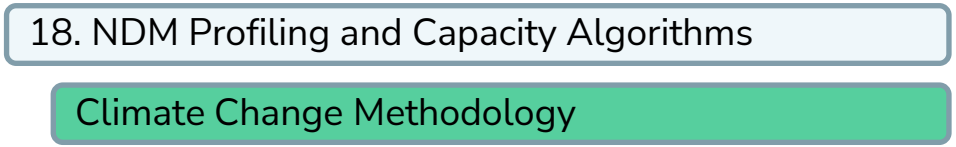
Reminder – Where to find data

- The DESC agreed Technical Requirements for the refresh of the CCM can be found at the following link:

Climate Change Methodology - Technical Requirements v1.0.pdf (gasgovernance.co.uk)

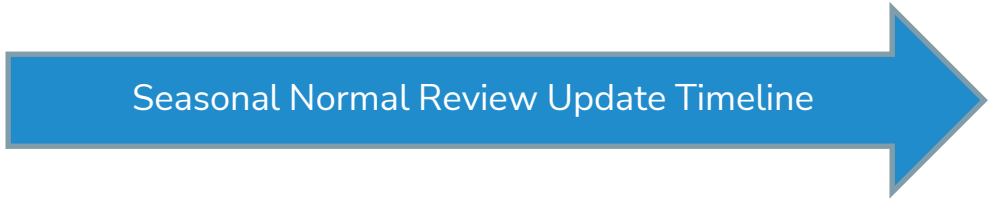
- All CCM output as defined in DESC's Technical Requirements will be published on the secure area of UK Link Docs

- Folder structure on Secure Website, links to secured area, and access request form can be found by following this link



- A sub-folder within the folder highlighted in green will contain the final output of the CCM refresh

Next Steps



Begin Trial Optimisation phase for selected LDZs

Q2 2024

DESC TWG to work with Met Office to produce refreshed CCM

Q2 2024

Met Office to deliver refreshed CCM

End June 2024

Present findings of Trial Optimisation phase to DESC

July 2024