DESC Approach to derivation of new Seasonal Normal Basis

Document Control

Version	Date	Reason for Change
Draft version 0.1	22-Sep-14	Initial draft of proposed approach for DESC review

DESC Approach to derivation of New Seasonal Normal Basis for use in UNC NDM Demand Estimation: 1st October 2015 to 30th September 2020

This document describes the process to be followed in order to revise the basis of the Seasonal Normal Composite Weather Variable (SNCWV). This process follows the completion of the review and where appropriate revision of the Composite Weather Variable (CWV) definitions.

Background

The legal obligations relating to this process are referenced in Uniform Network Code (UNC) Section H and the UNC Transition document Part IIC – Transition Rules.

UNC Section H 1.5.4 states "*the relevant Sub-committee will, at appropriate frequencies determined by it, after consultation with the Uniform Network Code Committee or any other relevant Sub-committee, review and where appropriate revise (with effect from the start of a Gas Year) the seasonal normal value of the Composite Weather Variable for an LDZ*".

UNC Section H 1.5.2 states "*the seasonal normal value of the Composite Weather Variable for an LDZ for a Day in any year will be determined by the relevant Sub-committee".*

In this instance, the relevant Sub-committee is the Demand Estimation Sub-Committee (DESC).

Following the implementation of UNC Modification 330, the concept of a Climate Change Methodology (CCM) was introduced to Section H and the Transition document. The CCM represents a methodology developed by a reputable meteorological services company which can then be used to adjust historical weather observations to take into account climate change trends. Pending approval by DESC these adjusted values can then be incorporated in the derivation of the SNCWV.

Seasonal Normal Review 2015

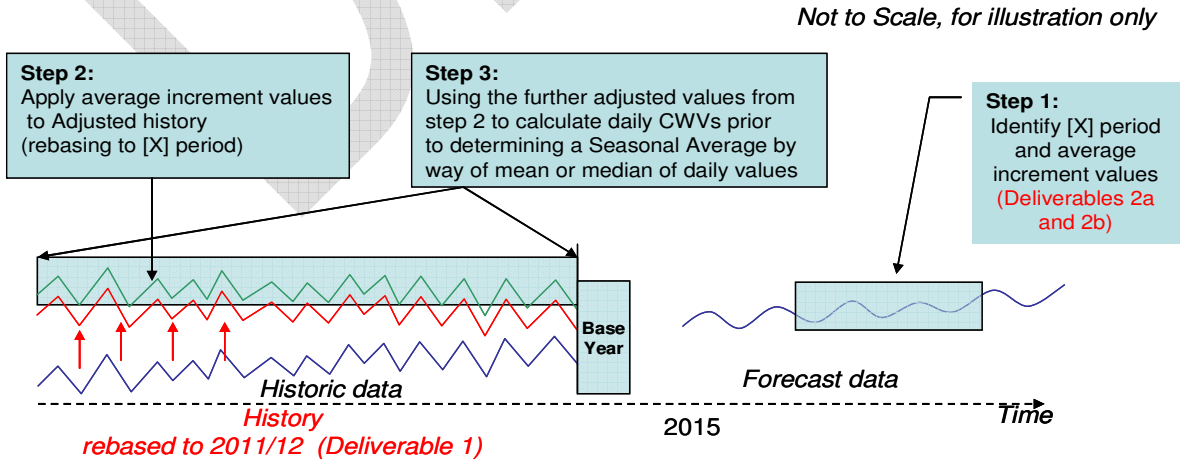
For this particular Seasonal Normal Review cycle (2013-14), the reputable meteorological services company selected to develop the CCM was the 'Met Office'. The Met Office delivered both a methodology document and a series of data outputs reflecting a set of technical requirements developed by DESC.

The final CCM document and associated data outputs signed off and approved by DESC are available to the industry via the secure Xoserve website – UK Link Documentation. The location is: 18.NDM Profiling and Capacity Estimation Algorithms / Climate Change Methodology.

To ensure the Met Office delivered a product the gas industry were expecting and would be satisfied with, a sub group of industry experts from DESC (known as the 'Stakeholder Group') joined Xoserve at various key points throughout the project.

In November 2013, the Stakeholder Group met with Xoserve to agree how the various outputs, due to be delivered by the Met Office, should be used when deriving the SNCWV. A high level process diagram (Fig. 1) was prepared and presented to DESC's Technical Workgroup and was formally approved on 27th November 2013. This forms the foundation of the more detailed descriptions of how the SNCWV should be calculated which is explained in the next section.

Fig.1



Deliverables:

1) *An adjusted view of historic hourly weather datasets (derived from WSSM) reflecting estimated impacts of climate change based on results from base year 2011/12*
2) *a) Predicted hourly climatological average values for period 1st October 2012 to 30th September 2025 based on predicted impact of climate change trends for future period*
   b) Predicted hourly increments values – difference between predicted hourly climatological average values (i.e. from 2a) and base year (2011/12) averages

Summary of DESC's proposed approach

One of the key principles of this approach is to ensure any industry party, who is a signatory of the Uniform Network Code, has the ability to replicate the calculations. This can be achieved because all of the data used in the process will be available on the secure area on Xoserve's website.

DESC's proposed approach for deriving the new seasonal normal basis (SNCWV) has been summarised as follows:

"Step 1: Identify [X] period and average increment values"

1.1 Following analysis of the Climate Change Methodology (CCM) projections for 4 Trial LDZs (SC, NE, WM and SW) a decision was made by the DESC Technical Workgroup at its meeting on 18th August 2014 to use a period of **5 years** to average the increment values. The 5 year period selected was 1st October 2015 to 30th September 2020.

The calculation of average hourly increments is only required for the Temperature weather variable. This is because, as explained in the CCM report, *"there is low confidence in the existence of any observed long-term trend in wind speed"* hence there are no associated increments for the Wind Speed weather variable to average.

1.2 For each of the gas industry weather stations retrieve the appropriate increments file for the Temperature weather variable. This file will be named as follows: 'Temperature_weatherstationID_increment_2012_2025.txt'.

1.3 All of the CCM outputs are stated in GMT and so should be converted to Local Time.

1.4 Selecting all records from the period 01/10/2015 00:00 to 30/09/2020 23:00 calculate the mean increment value for each hour for each calendar day, excluding any records associated to 29th February in the data series. The mean increment value should be rounded to 1 d.p.

1.5 Calculate the mean hourly increment value for 29th February by averaging the equivalent hourly values for 28th February and 1st March. The mean hourly increment value should be rounded to 1 d.p.

"Step 2: Apply average increment values to adjusted history (rebasing to [X] period)"

2.1 The values calculated in steps 1.4 and 1.5 represent the "*average increment values*" which need to be added to the adjusted history thus "*rebasing to [the average of the 5 year] period*". The adjusted history has been calculated by the Met Office and is provided as one of the CCM outputs.

2.2 For each of the gas industry weather stations retrieve the appropriate adjusted history file for the Temperature weather variable. This file will be named as follows: 'Temperature_weatherstationID_adjhist.txt' and contains hourly records from 01/01/1960 00:00 to 30/09/2012 23:00.

2.3 This file contains an adjusted view of the historic hourly weather datasets derived from the Weather Station Substitution Methodology (WSSM) phase, reflecting the estimated impacts of climate change based on results from the base year of 2011/12. As it was derived from the WSSM phase, those records where reliable estimates (as per the methodology) were not able to be calculated, will also be missing in the 'adjhist' file. As with the WSSM data these records are populated with a value of -32768.

The data in 'adjhist' will be used in the process of calculating the Composite Weather Variable history (Step 3), these missing records will need to be populated with a 'filled-in' value. An approach to infilling was signed off by TWG for use in the WSSM data series. It is proposed the same methodology is used for those records in the CCM data series. Details of the methodology can be viewed on the following link:

** Insert link here **

Only Temperature has been adjusted to account for trend in the time series. For the remaining weather variables there was either no evidence in the scientific literature and/or the analysis to conclude that there was a trend due to climate change. For all variables apart from temperature, the adjusted time series (adjhist) are the same as the datasets for the Weather Station Substitution Methodology, except that columns 6 and 7 have been removed. This means for all weather variables other than temperature it will be possible to directly use the in-filled values from the WSSM data series. Missing records in the Temperature data series will need to be calculated using the agreed methodology.

2.4 Identify all records in the Temperature adjhist file where the value is -32768 and surrounding records. Apply methodology referenced in step 2.3 and update relevant records.

Note: Xoserve have performed these calculations and provided the revised data files on ……, these can be viewed in the following location……..

Appendix 1 summarises the number of missing records by decade for each gas industry weather station where the methodology has been applied.

2.5 All of the CCM outputs are stated in GMT and so should be converted to Local Time.

2.6 Add the appropriate mean hourly increment value (referenced in step 1.4) to all records in the updated 'adjhist' data series referenced in the previous step and round to 1 d.p. The resultant values will effectively have been 're-based' to reflect the 5 year average period of 1st October 2015 to 30th September 2020.

2.7 The Composite Weather Variable (CWV) calculation requires the adjhist Temperature data series (at the end of step 2.6) and the adjhist Wind Speed data series. As explained in step 1.1 there has been no climate change adjustment made to the adjhist Wind Speed data series, although an output from the Climate Change project has still been produced (Windspeed_weatherstationID_adjhist.txt).

2.8 For each of the gas industry weather stations retrieve the appropriate adjusted history file for the Wind Speed weather variable. This file will be named as follows: 'Windspeed_weatherstationID_adjhist.txt' and contains hourly records from 01/01/1960 00:00 to 30/09/2012 23:00.

2.9 As with the Temperature data series there will be records that are missing which again will be populated with a value of -32768. These records will need to be filled-in, as stated in step 2.3 these records can be filled in using the filled-in WSSM data series. Appendix 2 summarises the number of missing records by decade for each gas industry weather station where the methodology has been applied.

2.10 Once the filled-in phase has been completed it should then be converted to Local Time.

2.11 Convert the wind speed values into knots (Met Office supplied CCM data in metres per second). Multiply value by 1.943844 and round to whole number.

This completes all of the activities necessary to prepare the CCM Temperature and Wind Speed data series ready for use in calculating daily CWVs in Step 3.

"Step 3: Using the further adjusted values from step 2 to calculate daily CWVs prior to determining a Seasonal Average by way of mean or median of daily values".

3.1 For each weather station a daily temperature and wind speed need to be derived. All daily temperatures and wind speeds are derived from within day values (2-hourly and weighted for temperatures and 4-hourly unweighted for wind speeds). The weightings applied are provided in Appendix 12 of each year's NDM report.

3.2 Apply the revised definitions of CWV to the ensuing computations. Note that CWV definitions are based on the fit of daily values of demand to daily values of weather (temperature and wind speed).

3.3 Calculate a CWV for each day in the period 1st October 1960 to 30th September 2012. Effectively this will result in 52 different versions of CWV for any given day in a gas year. Note: Create an Effective Temperature series from 1st January 1960 and use the Effective Temperature value on 30th September 1960 as the input to the CWV calculations from gas day 1st October 1960 onwards.

3.4 In order to create a single CWV value for each day in the target gas year calculate the mean/median of each set of 52 separate CWV values. Note that 29th February is ignored in all calculations. The SNCWV for 29th February is later set to the average of the values of the two adjacent days.

3.5 This gives an unsmoothed value of CWV for each day of the target year.

3.6 Smooth the computed CWV profile using the loess method of data smoothing to remove excessive day-to-day variation in CWV profile. Apply smoothing so as to ensure that the overall area under the curve is not altered (no additional warming or cooling introduced).

When smoothing ensure retention of the kinks and bumps evident in visual observation of the EP2-WP2 temperature curve.
The fixed increment method was initially undertaken for a single example instance (WM LDZ) to verify feasibility. The results, including the impacts on key NDM EUC profiles, were assessed and presented to DESC.

Annex

Appendix 1:

Number of records in 'Temperature_weatherstationID_adjhist.txt' where in-filling methodology has been applied.

Weather Station Name / ID	Period where missing records present (-32768)			
	1960s	1970s	1980s	Total
Glasgow Bishopton / 03134	2	6	3	11
Albermarle / 03238	457	1	-	458
Rostherne No.2 / 03351	190	179	125	494
Nottingham Watnall / 03354	11	-	-	11
Winterbourne No.2 / 99062	42	11	5	58
St.Athan / 03716	241	17	4	262
London Heathrow / 03772	-	-	-	0
Southampton / 99079	11,702	5,840	-	17,542
Filton / 03628	30	-	-	30

Appendix 2:

Number of records in 'Windspeed_weatherstationID_adjhist.txt' where in-filling methodology has been applied.

Weather Station Name / ID	Period where missing records present (-32768)					
	1960s	1970s	1980s	1990s	2000s	Total
Glasgow Bishopton / 03134	-	1027	1	1	1	1030
Albermarle / 03238	473	1	1	3	2	480
Rostherne No.2 / 03351	-	-	1	3	7	11
Nottingham Watnall / 03354	2	-	-	-	-	2
Coleshill / 03535	-	-	1	-	-	1
St.Athan / 03716	-	-	1	-	-	1
London Heathrow / 03772	-	-	-	-	-	0
Southampton / 99079	-	-	-	3	-	3
Filton / 03628	2	-	1	1	-	4