DESC Approach
to derivation of new
Seasonal Normal Basis for 1
October 2015 onwards

Document Control

Version	Date	Reason for Change
Draft version 0.1	22-Sep-14	Initial draft of proposed approach for DESC review
Final version 1.0	07-Nov-14	DESC approved approach document on 15th October 2014 Additional paragraph added to reflect DESC approval of agreed smoothing technique
Final version 1.1	08-Jan-15	Minor amendments plus added location of filled-in data

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 there is a requirement in Section H and the Transition document to develop a Weather Station Substitution Methodology (WSSM) and Climate Change Methodology (CCM) from a reputable meteorological services company. The WSSM represents a methodology which can be used in the event of a weather station change. One of the deliverables from this project was a set of historical weather observations for the gas industry weather stations. The CCM represents a methodology which can be used to adjust the WSSM historical weather observations to take into account climate change trends.

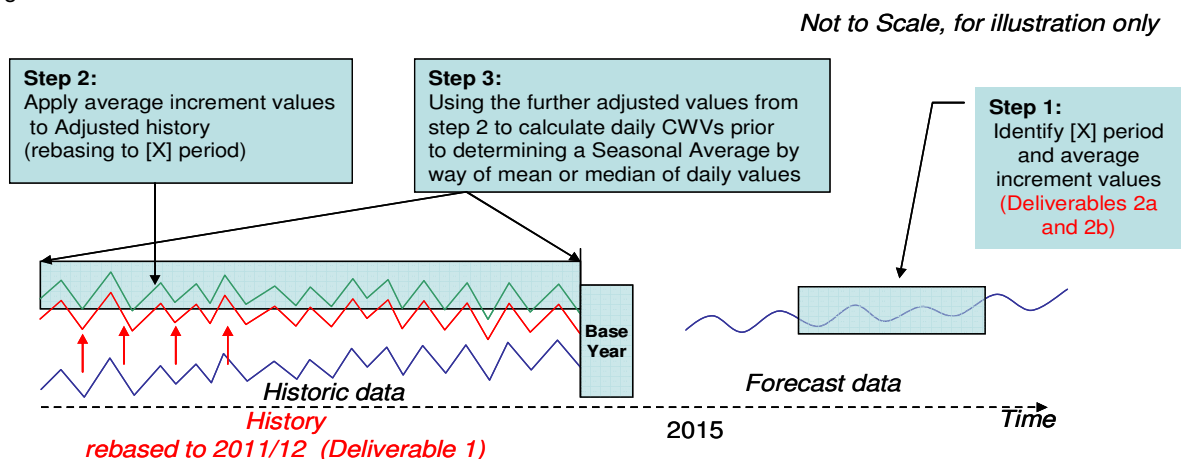## Seasonal Normal Review 2015

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 that the gas industry were expecting and would be satisfied with, a sub group of industry experts from DESC (known as the 'Stakeholder Group') supported the development of the Methodology and datasets 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 on 27th November 2013 and it was also shared with DESC on 25th June 2014. 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

Not to Scale, for illustration only

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

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

Step 1: Identify [X] period and average increment values (Deliverables 2a and 2b)

Base Year

Historic data

Forecast data

History rebased to 2011/12 (Deliverable 1)

2015

Time

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 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"*. As such, while increments for the Wind Speed weather variable have been provided as part of the CCM datasets they have not been used in the subsequent steps.

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'. Location: Folder 18 / Climate Change Methodology / 3.Final Datasets

1.3   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.

1.4   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. Add this to the dataset in 1.3 to produce a dataset of all the mean hourly increments.

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

2.1   The values calculated in steps 1.3 and 1.4 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. Location: Folder 18 / Climate Change Methodology / 3.Final Datasets

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 that the same methodology is used for those records in the CCM data series. The methodology document can be viewed on the secure area of Xoserve's website, UK Link Docs with the location shown below:

18.NDM Profiling and Capacity Estimation Algorithms / Weather Station Substitution Methodology / 5.Supporting Information for Historic Datasets / DESC_Infill_Methodology

Only Temperature has been adjusted to account for a 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 published the data on the secure area of Xoserve's website, UK Link Docs, with the location shown below:

18.NDM Profiling and Capacity Estimation Algorithms / Climate Change Methodology / 3. Final Datasets / *Weather Station* / Temperature_*Weather Station ID_adjhist_infill*

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

2.5 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.

2.6 The Composite Weather Variable (CWV) calculation requires the adjhist Temperature data series (at the end of step 2.5) 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).

2.7 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.
Location: Folder 18 / Climate Change Methodology / 3.Final Datasets

2.8 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. Appendix 2 summarises the number of missing records by decade for each gas industry weather station where the in-fill methodology has been applied.

Note: Xoserve has performed these calculations and published the data on the secure area of Xoserve's website, UK Link Docs, with the location shown below:

18.NDM Profiling and Capacity Estimation Algorithms / Climate Change Methodology / 3. Final Datasets / *Weather Station / WindSpeed_*Weather Station ID_adjhist_infill*

2.9 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.

2.10 Once the 'In-filling' phase has been completed it should then be converted to Local Time - Appendix 3 for more details

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 weighted for temperatures and the 4-hourly unweighted mean for wind speeds).

Note: Further to the future change in gas day arrangements expected from October 2015, DESC agreed on 30th July 2014 that the 2-hourly temperatures used to derive the daily temperature value should be based on 5am to 3am rather than the current 7am to 5am. The 4 hourly wind speed timeslots remain as-is.
Appendix 4 provides clarification on weightings for temperature and wind speed.

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 total LDZ NDM 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 a 365 day year calculate the mean 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 daily average value of CWV adjusted for the predicted impacts of climate change for the period October 2015 to September 2020 for each day of a 365 day year.

The unsmoothed values alone will not be appropriate to use directly in the EUC modelling processes. A smoothing technique is therefore required to a) remove excessive day-to-day variation in the CWV profile b) ensure that the overall area under the curve is not altered (no additional warming or cooling introduced) and c) ensure retention of the kinks and bumps are evident in the visual inspection of the final smoothed profile.

DESC decided at its meeting on 15th October 2014 that a **5 day centred moving average** achieves all of the above objectives and ensures all industry parties are able to replicate the end to end SNCWV calculation.

3.6   Smooth the computed CWV profile using a 5 day centred moving average. This should be rounded to 2 d.p.

3.7   Calculate a SNCWV value for 29th February by averaging the equivalent daily values for 28th February and 1st March. This value should be rounded to 2 d.p. Add this to the dataset from step 3.6 to give a complete dataset of 366 SNCWVs for each LDZ.

Annex

Appendix 1: (referenced in Step 2.4)

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: (referenced in Step 2.8)

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

Appendix 3: (referenced in Steps 2.10)

GMT to BST Correction Summary

Calendar Year	1st Spring Correction +1 @ 02:00 GMT	Final Autumn Correction +1 ' 00:00 GMT
1960	27th March	30th October
1961	26th March	29th October
1962	25th March	28th October
1963	31st March	27th October
1964	29th March	25th October
1965	28th March	31st October
1966	27th March	30th October
1967	26th March	29th October
1968	31st March	27th October
1969	30th March	26th October
1970	29th March	25th October
1971	28th March	31st October
1972	26th March	29th October
1973	25th March	28th October
1974	31st March	27th October
1975	30th March	26th October
1976	28th March	31st October
1977	27th March	30th October
1978	26th March	29th October
1979	25th March	28th October
1980	30th March	26th October
1981	29th March	25th October
1982	28th March	31st October
1983	27th March	30th October
1984	25th March	28th October
1985	31st March	27th October
1986	30th March	26th October
1987	29th March	25th October
1988	27th March	30th October
1989	26th March	29th October
1990	25th March	28th October
1991	31st March	27th October
1992	29th March	25th October
1993	28th March	31st October
1994	27th March	30th October
1995	26th March	29th October
1996	31st March	27th October
1997	30th March	26th October
1998	29th March	25th October
1999	28th March	31st October
2000	26th March	29th October
2001	25th March	28th October
2002	31st March	27th October
2003	30th March	26th October
2004	28th March	31st October
2005	27th March	30th October
2006	26th March	29th October
2007	25th March	28th October
2008	30th March	26th October
2009	29th March	25th October
2010	28th March	31st October
2011	27th March	30th October
2012	25th March	

Appendix 4: (referenced in Step 3.1)

Within day temperature and wind speed weightings

 - Temperature

Actual temperatures (°C) are recorded every two hours. These two-hourly temperatures are weighted, to calculate the daily actual temperature for a gas day. The date of the gas day is that associated with the start of the gas day. The timings and weightings to be applied before and after the implementation of the change of Gas Day were agreed at DESC on 30/07/14 and are shown below.

Gas Years **up to** and including **2014/15** - Temperature			Gas Years **2015/16** and **onwards** - Temperature		
TIME	WEIGHT		TIME	WEIGHT	
07:00	0.1		05:00	0.05	
09:00	0.1		07:00	0.1	
11:00	0.1		09:00	0.1	
13:00	0.1		11:00	0.1	
15:00	0.1		13:00	0.1	
17:00	0.1		15:00	0.1	
19:00	0.1		17:00	0.1	
21:00	0.1		19:00	0.1	
23:00	0.05		21:00	0.1	
01:00	0.05		23:00	0.05	
03:00	0.05		01:00	0.05	
05:00	0.05		03:00	0.05	

 - Wind Speed

Actual wind speeds are recorded every four hours at the times shown below. A daily average wind speed is calculated from the unweighted mean of these four-hourly wind speeds:

Gas Years **up to** and including **2014/15** – Wind Speed	Gas Years **2015/16** and **onwards** – Wind Speed
07:00 11:00 15:00 19:00 23:00 03:00	07:00 11:00 15:00 19:00 23:00 03:00