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DESC Technical Workgroup

CWV Optimisation Background

22th September 2014

Contents

- Composite Weather Variable (CWV)
  - Background
  - Approach Summary

CWV Optimisation

Background

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The Composite Weather Variable (CWV)

- Background
  - The relationship between weather and demand is fundamental to demand estimation and forecasting processes. It is important to produce a weather variable that provides the strongest possible 'fit' for the weather and demand models
- What is the Composite Weather Variable (CWV)
  - The CWV is a single measure of daily weather in each LDZ and is a function of effective temperature, wind speed and pseudo Seasonal Normal Effective Temperature (SNET)
- What is its purpose ?
  - The CWV is defined to give a linear relationship between Monday to Thursday non holiday daily aggregate NDM demand in the LDZ and the CWV
  - The definition of the CWV includes provision for summer cut-offs and cold weather upturn during low temperature periods

Calculating the CWV

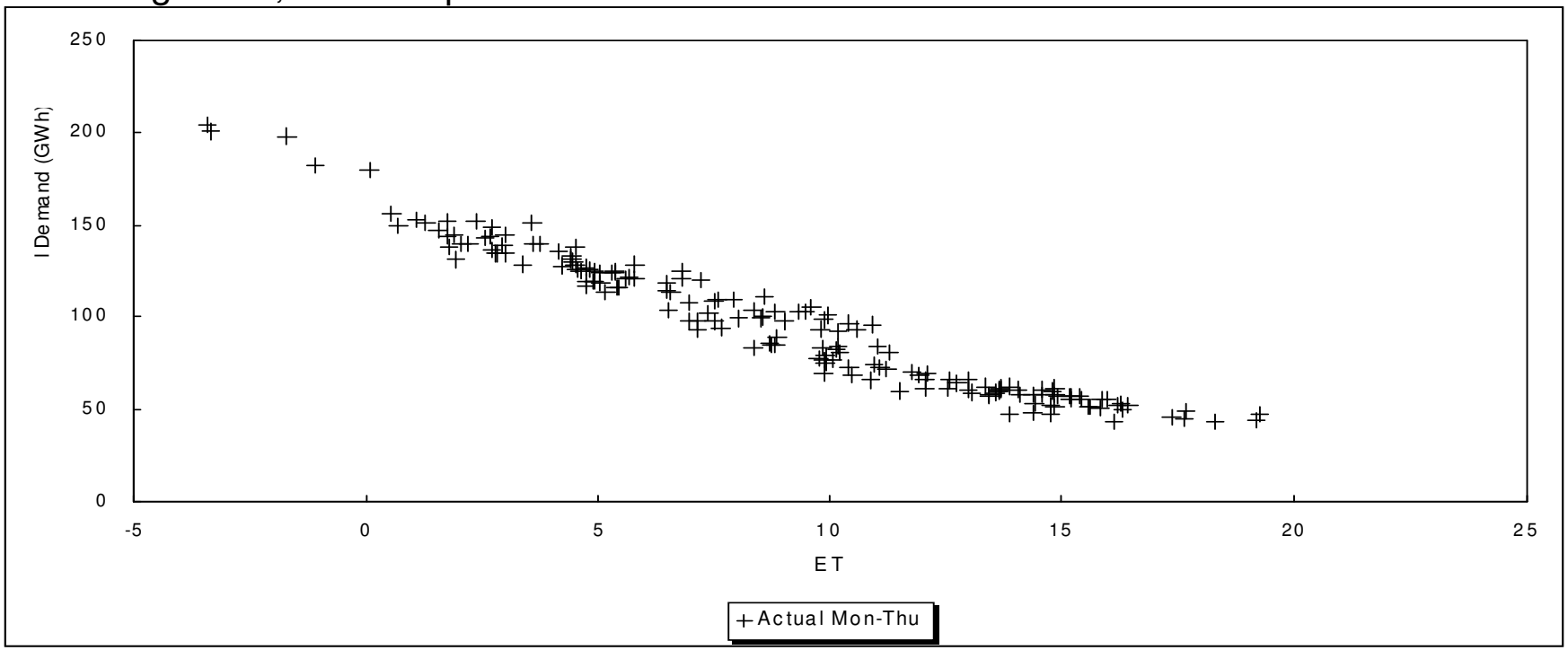
- To calculate the daily CWV values a combination of actual weather data and a set of parameters (defined at the start of a new weather station or during the seasonal normal review) are required
- Part I – The first part of the formula includes the raw weather data to which various weightings are applied. In effect the CW is an intermediate term in the definition of the CWV
- CW is made up of an effective temperature, a pseudo seasonal normal effective temperature and a wind chill term

Calculating the CWV

- In effect the CW is the CWV without summer cut-offs and cold weather upturn
- Part II – The second part of the formula will incorporate parameters relating to cold or warm days depending on the outcome of the CW calculation
  - Summer cut-offs
  - Cold weather upturn
- So why are parameters required ?.....

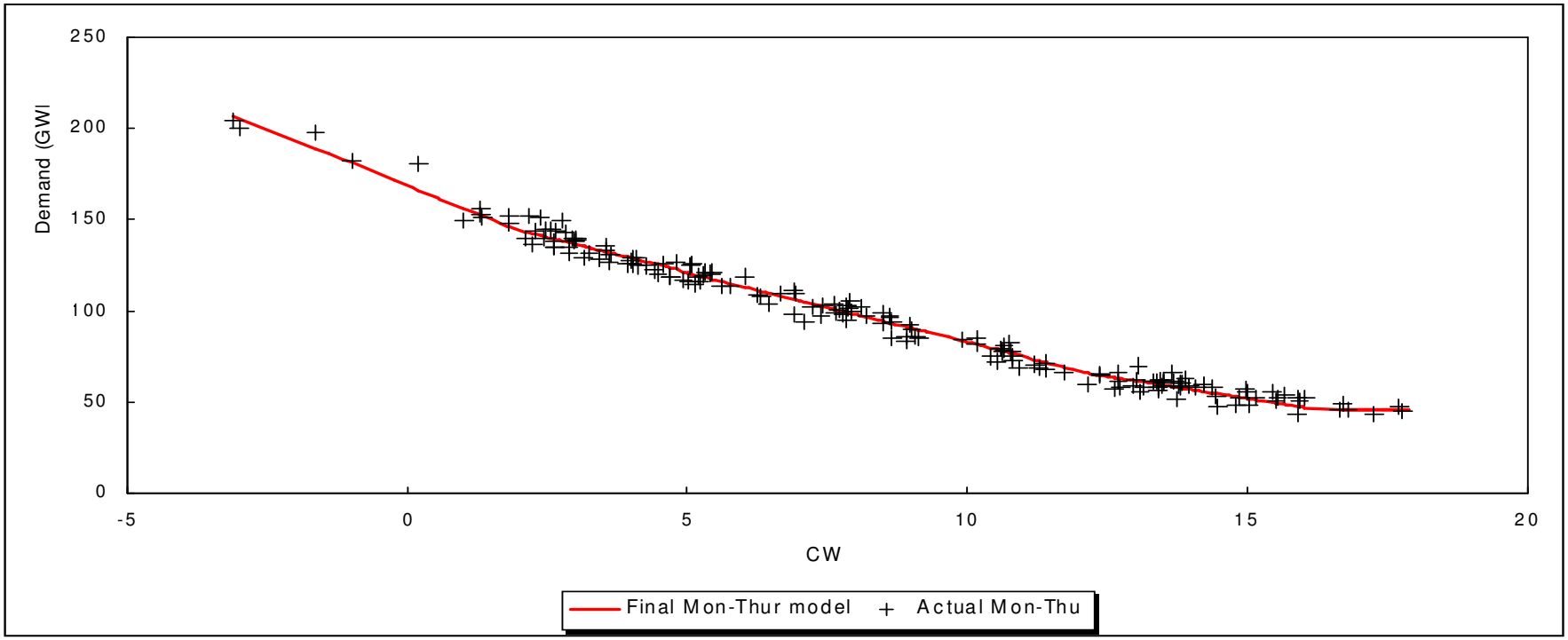
Monday to Thursday non-holiday Demand against Effective Temperature

- The weather, based on Effective Temperature alone and demand relationship is not a straight line, for example:



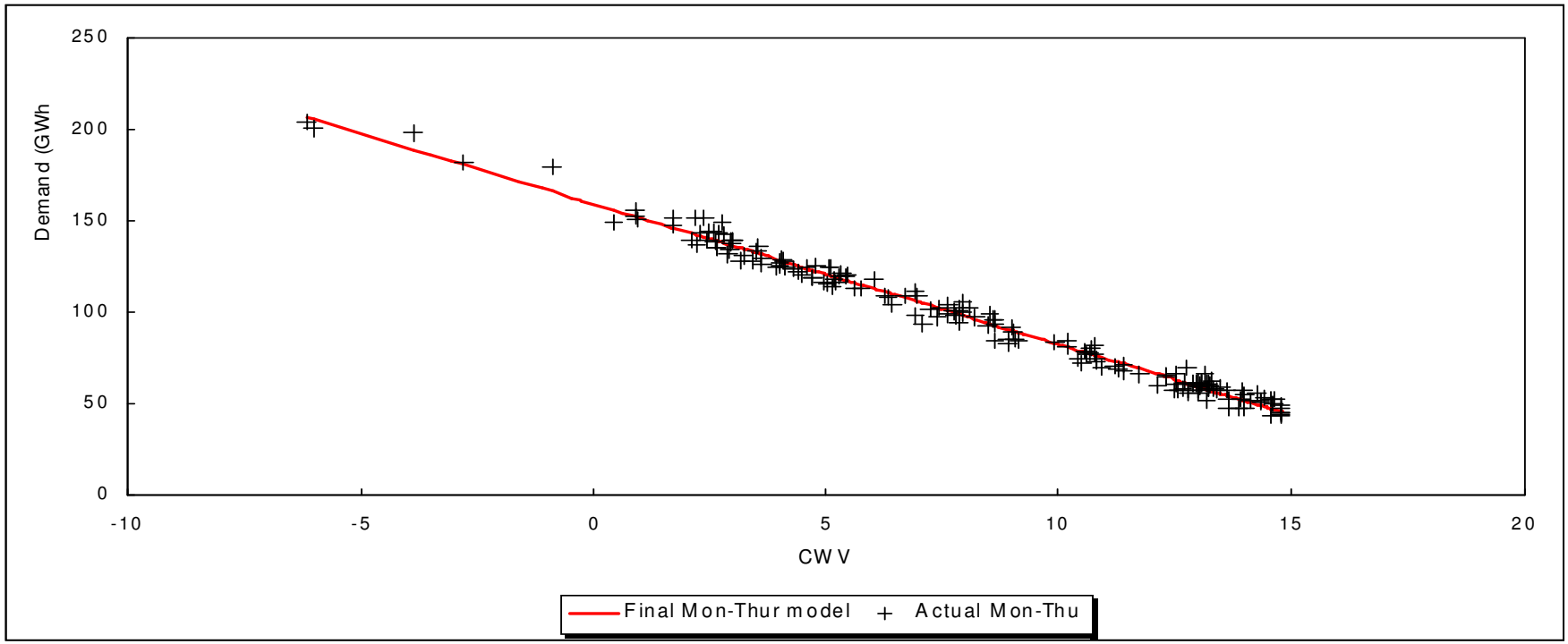
Monday to Thursday Non-Holiday Demand against CW
(CWV before cold and warm weather adjustments)

- CW combines effective temperatures, pseudo seasonal normal effective temperatures and wind chill into a single weather variable – better fit than previous graph but can do better…

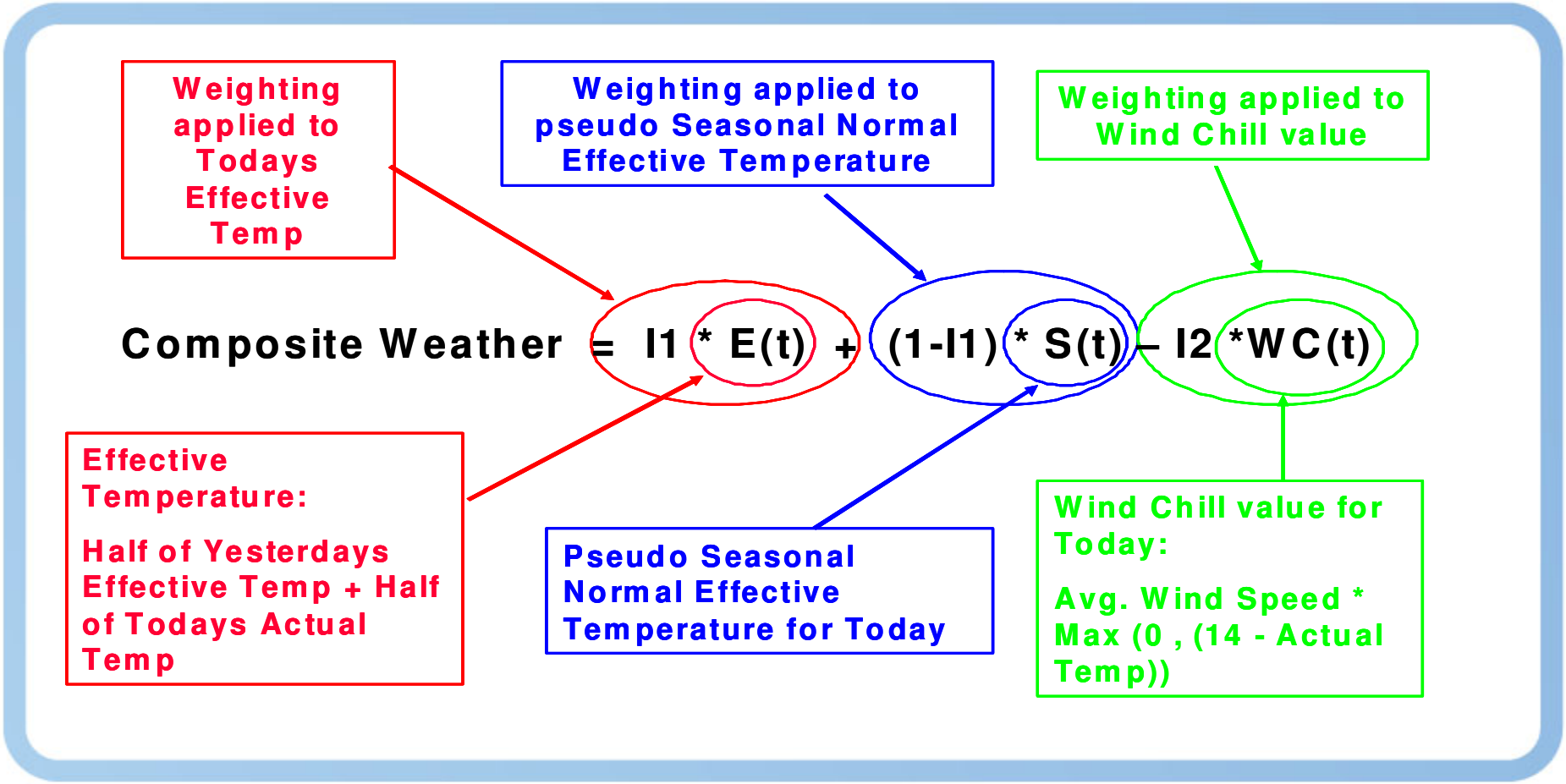


Monday to Thursday non-holiday Demand against CWV

- CWV adjusts CW for cold weather upturn and summer cut off providing an even better fit between weather and demand



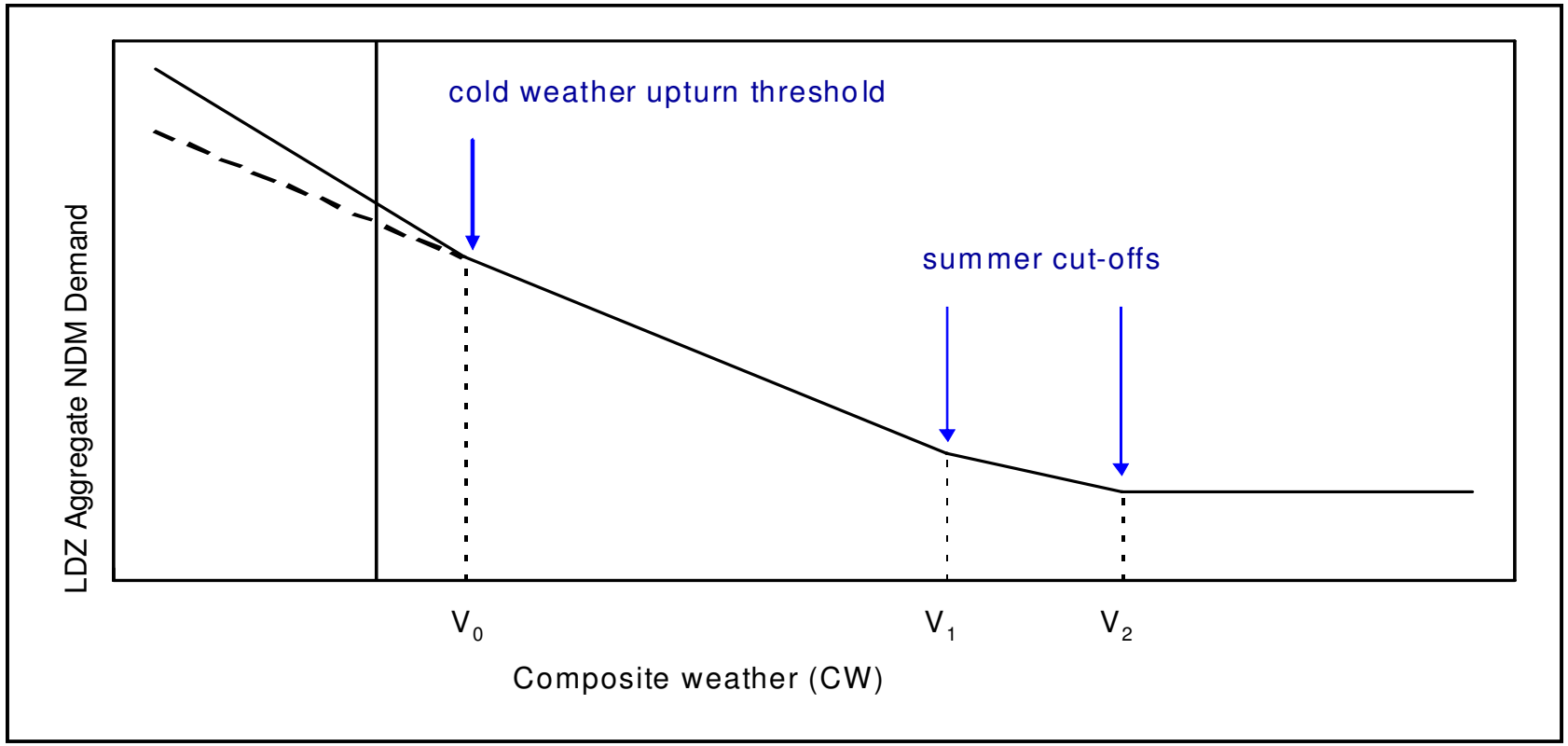
Composite Weather Variable Formula
Part 1 - CWV



Composite Weather Variable Formula Part 2 - CWV

- Series of tests applied to the CW value (using parameters below) to determine if changes need to be made. Parameters to consider:
  - V0 – Cold Weather Upturn Threshold
  - V1 – Lower Warm Weather Cut-Off
  - V2 – Upper Warm Weather Cut-Off
  - Q – Slope relating to Warm Weather Cut-off
- **'Normal'**: If CW is > cold weather threshold and < lower warm weather cut off: **CWV = CW.**
- '**Summer Transition**': If CW is > lower warm weather cut-off but < upper warm weather cut-off:
  CWV = Lower Cut-Off + Slope * (CW – Lower Cut-Off)
- '**Summer Cut-Off**': If CW is > upper warm weather cut off:
  CWV = Lower Cut-Off + Slope * (Upper Cut-Off – Lower Cut-Off)
- '**Cold Weather Upturn**': If CW is < cold weather upturn threshold:
  CWV = CW + Cold Weather sensitivity * (CW – Cold Weather Upturn Threshold)

Composite Weather Variable: Schematic



Why does the CWV need to be reviewed

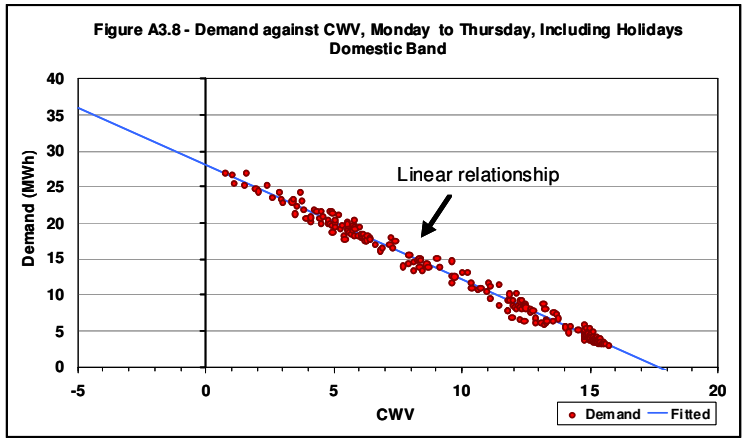
- UNC (H1.4.2) requires the relevant Sub-committee (DESC) "*to review and where appropriate revise with effect from the start of a gas year the formula by which the CWV for an LDZ will be determined*"
- DESC asked its Technical Workgroup to preside over the detailed analysis and provide recommendations back to DESC
- Last review carried out in autumn 2009 and implemented on 1st October 2010. The next comprehensive review will be performed in autumn 2014 in order to support an implementation on 1st October 2015
- The review is usually done in conjunction with an update of the Seasonal Normal basis which is also scheduled to be revised in readiness for Gas Year 2015/16

Composite Weather Variable: Existing Parameters

LDZ	Weather Station	I_1	I_2	I_3	V_0	V_1	V_2	q	W_0	T_0
SC	Glasgow Bishopton	0.653	0.0118	0.19	3	13.2	16.0	0.64	0.0	14.0
NO	Albermarle Barracks	0.636	0.0102	0.50	0	12.5	15.7	0.56	0.0	14.0
NW	Hulme Library	0.661	0.0149	0.26	3	15.5	18.5	0.41	0.0	14.0
NE	Nottingham Watnall	0.692	0.0150	0.00	0	14.8	17.9	0.43	0.0	14.0
EM	Nottingham Watnall	0.687	0.0131	0.00	0	13.8	16.9	0.52	0.0	14.0
WM	Birmingham Winterbourne 2* (wind speeds Coleshill)	0.698	0.0104	0.23	1	14.0	17.9	0.39	0.0	14.0
WN	Hulme Library	0.661	0.0149	0.26	3	15.5	18.5	0.41	0.0	14.0
WS	St. Athan	0.634	0.0111	0.15	2	14.9	17.9	0.47	0.0	14.0
EA	London Heathrow	0.690	0.0118	0.00	0	15.1	19.1	0.37	0.0	14.0
NT	London Heathrow	0.703	0.0129	0.00	0	15.2	19.2	0.35	0.0	14.0
SE	London Heathrow	0.704	0.0125	0.05	3	15.1	19.0	0.37	0.0	14.0
SO	Southampton Oceanographic Institute	0.677	0.0127	0.39	2	14.8	18.1	0.38	0.0	14.0
SW	Filton Weather Station	0.637	0.0088	0.09	3	14.3	17.6	0.38	0.0	14.0

Composite Weather Variable (CWV)

- The CWV is a single measure of daily weather in each LDZ and is a function of effective temperature, wind speed and pseudo Seasonal Normal Effective Temperature (SNET)
- The CWV is defined to give a linear relationship between Monday to Thursday non holiday daily aggregate NDM demand in the LDZ and the CWV
- The relationship between weather and demand is fundamental to demand estimation and forecasting processes. It is important to produce a weather variable that provides the strongest possible 'fit' for the weather and demand models.



- This relationship is key to providing the Demand Estimation parameters:
  - Annual Load Profile (ALP)
  - Daily Adjustment Factor (DAF)
  - Load Factors
- The parameters are required for:
  - Allocation process
  - AQ calculation
  - Derivation of SOQ

CWV Optimisation

Approach Summary

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CWV – Scope of Review

- Following DESC's request for TWG to preside over the CWV optimisation analysis, an approach document was prepared and signed off
- It was agreed the scope of the review will focus on a fresh optimisation of the parameters within the existing CWV formula
- This review cannot consider fundamental changes, such as introducing a new weather variable or additional terms within the formula
- The aspiration of the industry to enhance and/or replace the CWV will need to be a consideration for DESC post UK Link replacement

Approach to CWV Optimisation Summary

- TWG agreed the Approach to CWV Optimisation document in April 2014
- The following summaries the main points from this agreement:
- A Trial calculation phase would take place in order to agree all of the key dates and principles for use in the main calculation phase in Q4
- 4 LDZs were selected for the Trial phase, these were NE, SC, SW and WM.
  - The weather stations associated with these LDZs had minimal requirements for data infilling
  - Covered a wide geographical area
- Optimisation to be performed over two different date ranges
  - Range 1: Extend existing years to include 2012/13 (additional 4 years) so 1996/97 to 2012/13
  - Range 2: Add additional 4 years and remove 4 years so 2000/01 to 2012/13.
  - *Range 3: Perform a run from 2004/05 to 2012/13 - Additional Request by TWG 18/8/14*

Approach to CWV Optimisation Summary

- Weather data series:
  - Use the WSSM datasets from 01/10/1960 to 30/09/2012
  - Fill in any gaps using the Infill Methodology proposed by E.On
  - From 30/09/2012 to 30/09/2013 use data in S&M (used to calculate CWVs)

- Demand data series
  - Suspect / unusual data for particular days or years may be excluded from the analysis or corrected
  - From Gas Year 2006/07 Xoserve shall use the Aggregate NDM demand adjusted to reflect known significant measurement errors
  - Cold weather upturn analysis to use only Aggregate NDM demand (TWG decision August 2014)

- Stages involved in deriving individual parameters agreed along with a requirement on Xoserve to share results of all of the various trials

Amendments to approach

- TWG agreed in August 2014 to the following changes to the original approach document:
  - **Gas day change**
    - Following TWG on 30th July Xoserve were asked to consider undertaking the trial assessment based on gas day running from 5am to 3am. Xoserve have updated system to allow this for the Trial and Production phases
  - **Use of non-holiday Monday to Thursday**
    - Initial investigations used the current EUC modelling holiday code rules to determine those days to exclude from Optimisation (16 holiday codes in total)
    - Xoserve wanted to ensure days were not removed from the analysis unnecessarily (particularly in the Summer) and following analysis of the results TWG agreed holiday codes >12 could still be excluded