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CWV Optimisation

TWG – 12th February 2014

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CWV Optimisation

Background

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Background

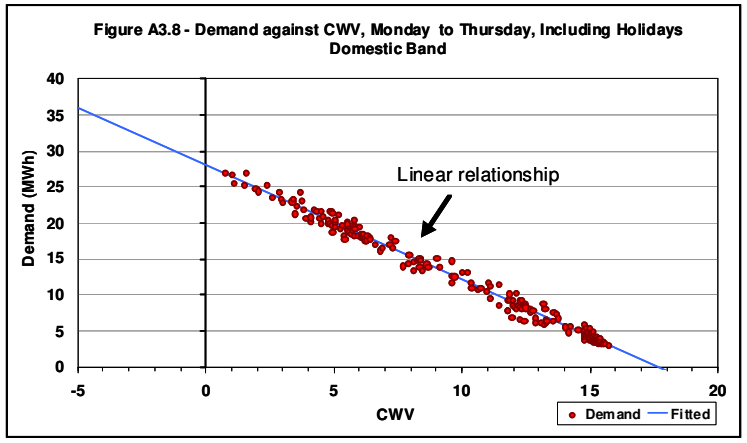
- UNC Section H 1.4.2 requires DESC to review and where appropriate revise the Composite Weather Variable (CWV) formula. This review is usually done in conjunction with an update of the Seasonal Normal basis

- With plans in place for a new SN basis for GY 2015/16 it's also time to consider the CWV formula definitions

- Last review carried out in autumn 2009 with revisions effective from 1st October 2010. The next comprehensive review will be performed in autumn 2014 in order to support a 2015/16 implementation

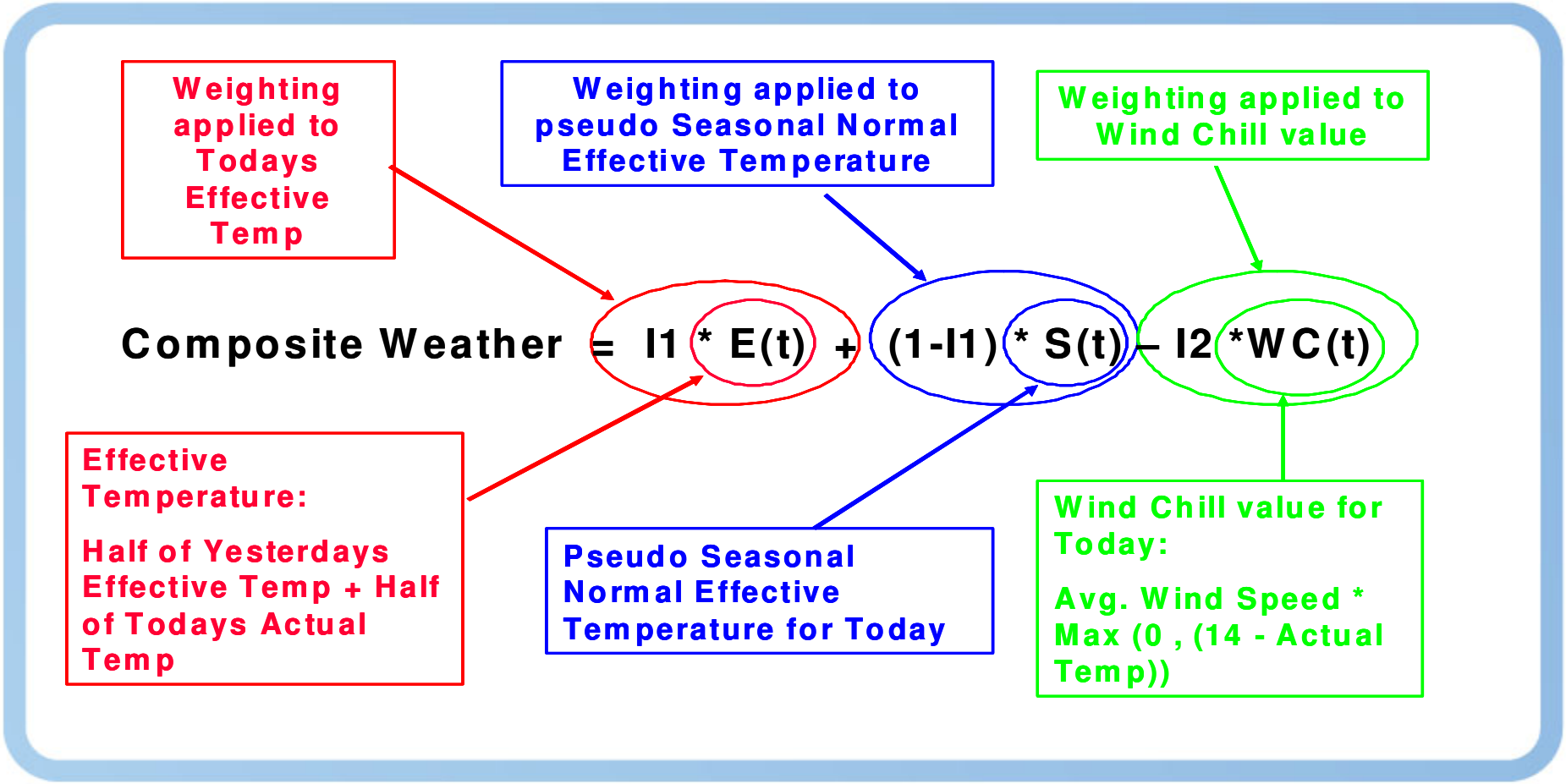
Composite Weather Variable (CWV)

- 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

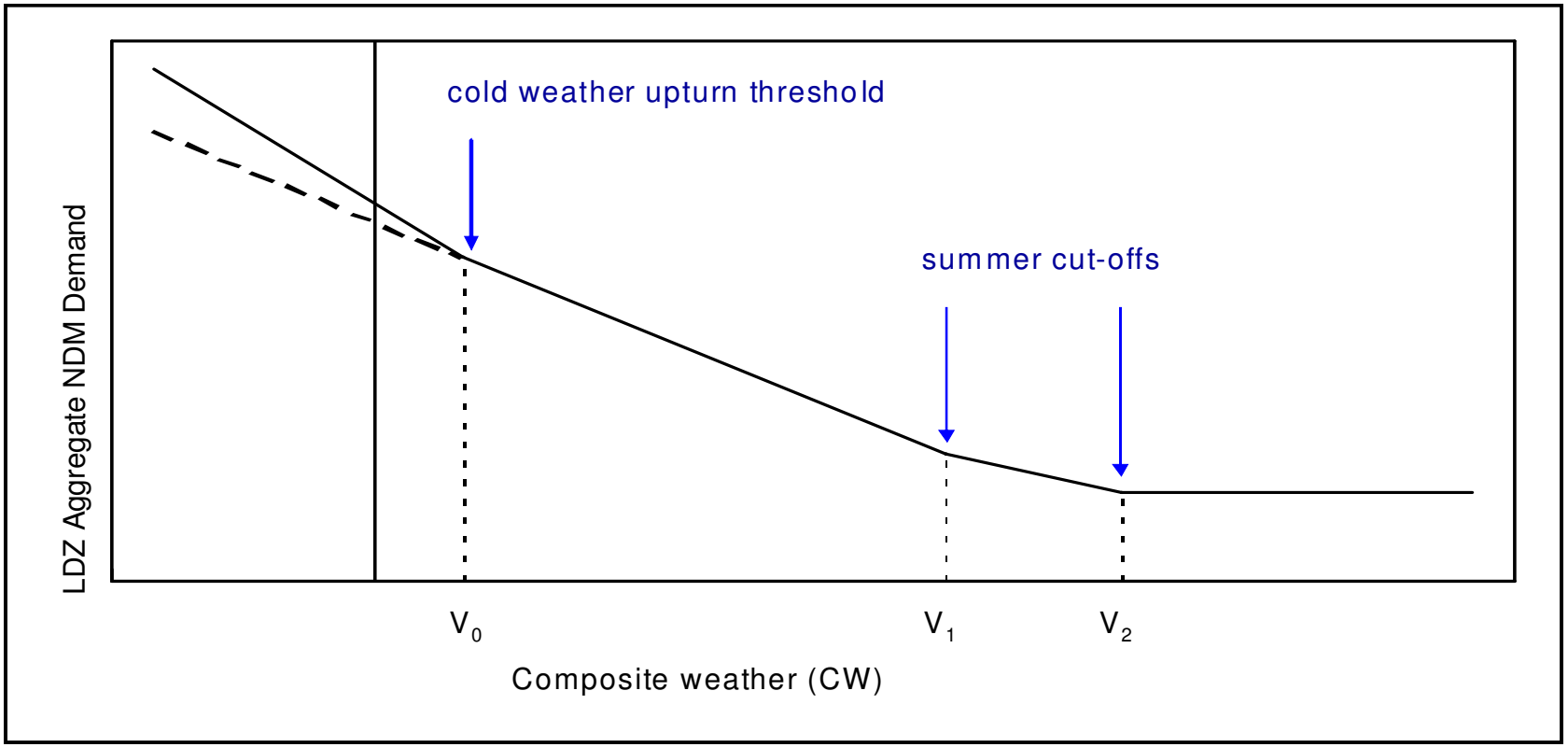
Composite Weather Variable Formula
Part 1 - CWV



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



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

CWV Optimisation

Approach

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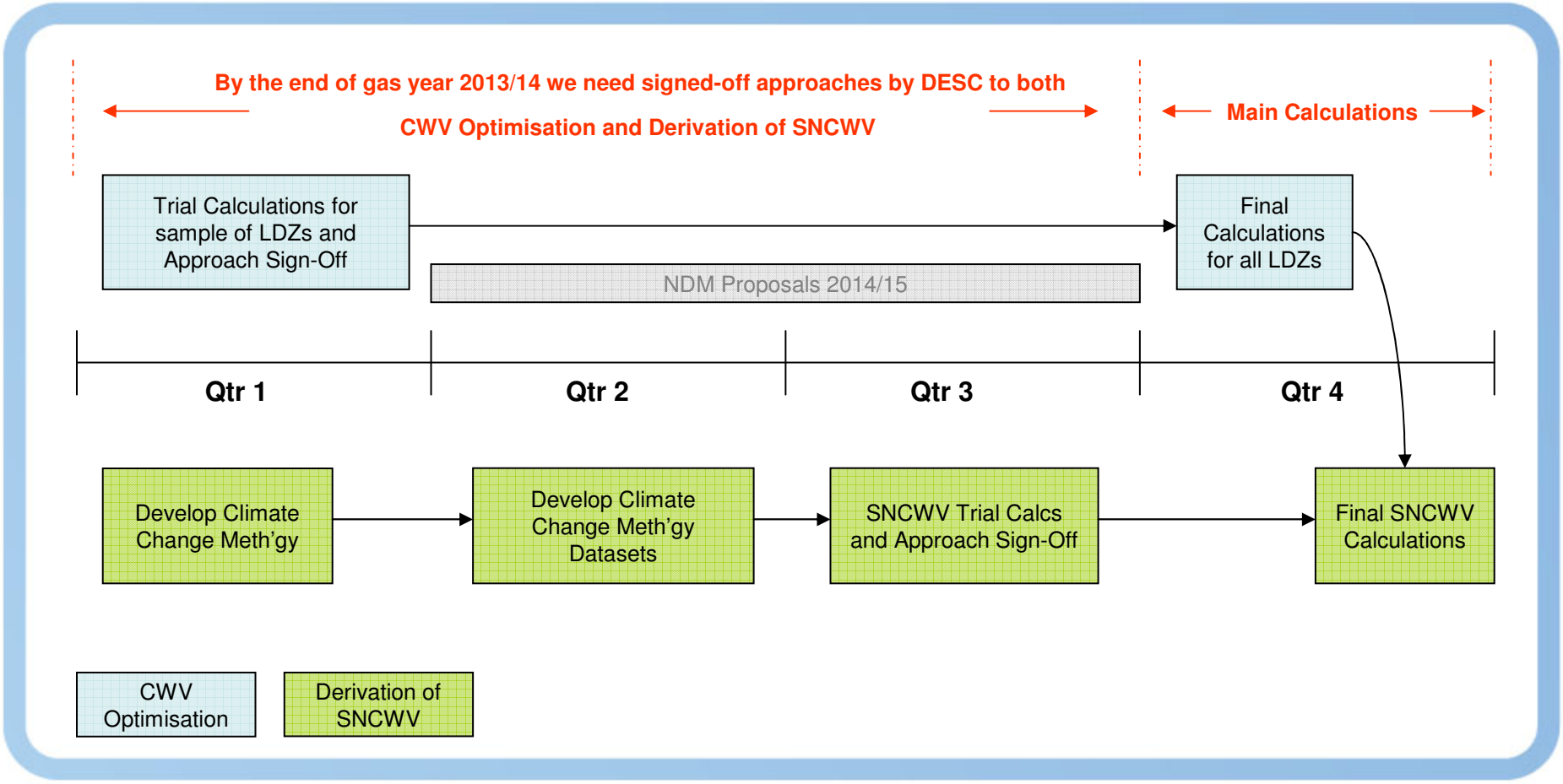
Scope of Review

- The scope of work for the review will focus on a fresh optimisation of the parameters used within the existing CWV formula
- The key activity will be to select the most appropriate number of years to achieve the optimum relationship to NDM demand
- Aware that an aspiration exists within TWG to review the formula more thoroughly within 18-24 months of UK Link replacement
- During the CWV Optimisation work the timeslots and weightings associated with Temperature and Wind Speed will remain as-is
  - Separate discussion to be had regarding impacts to CWV of proposed changes to gas day arrangements

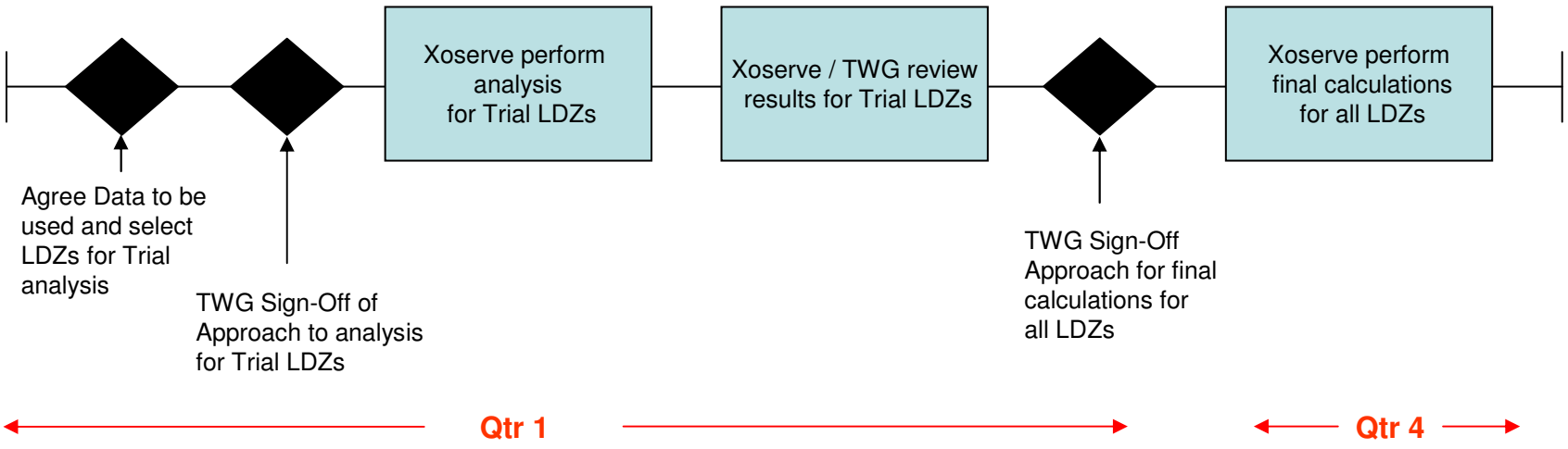
High Level Approach

- Number of stages involved in revising the CWV parameters for a particular LDZ that use demand and weather data from a number of gas years
- At each stage the values for one or more CWV parameter is estimated. For most of these stages, a range of possible values for the parameter(s) is investigated
- Regression models are derived for each gas year relating daily demand to CWV (on some or all non-holiday days) for each of the possible CWV parameter values
- The value(s) of the parameter(s) that produces the best fit of CWV to demand on average over the modelled gas years is chosen as the parameter estimate(s)
- If a particular gas year contains suspect demand or weather data, the demand model for that year may be excluded when selecting the best value(s) for the parameter estimate(s)

2014 Timeline



2014 Timeline – CWV Optimisation



Data Used and Number of Years relevant to current CWV Parameters and 1 in 20 CWV Estimates

Data	1 in 20 Peak CWV	I1, I2, V1, V2, Q, Pseudo SNET	I3,V0
Agg. NDM Demand	n/a	1996/97 to 2008/09	1996/97 to 2008/09
Maximum Potential Demand	n/a	n/a	1981/82 to 1995/96
Daily Temperatures from Gas Industry Weather Data Series	1928/29 to 2008/09	1996/97 to 2008/09	1981/82 to 2008/09
Daily Wind Speeds from Gas Industry Weather Data Series	1928/29 to 2008/09	1996/97 to 2008/09	1981/82 to 2008/09

Data Issues

- Most parameters currently based on demand and weather data from 01/10/96 to 30/09/09
- Cold weather upturn uses data back to early 1980s
- Estimate of 1 in 20 CWVs currently uses data back to 1928 – presumably this will move to Oct 1960 when moved to WSSM datasets
- WSSM dataset runs from 1960 to midnight on 30/09/12
- Gaps exist within WSSM dataset need to be filled prior to analysis being run
- In trial analysis if we are to run optimisation including gas year 2012/13 then WSSM data will need to be 'fused' with S&M data
- For all current gas stations then this will be possible apart from Winterbourne No.2 (use Edgbaston ?) and Rostherne we don't have data from Oct 12 upto Oct 13 when hybrid Rostherne is being used
- Need to agree number of years to be used in trial LDZ analysis

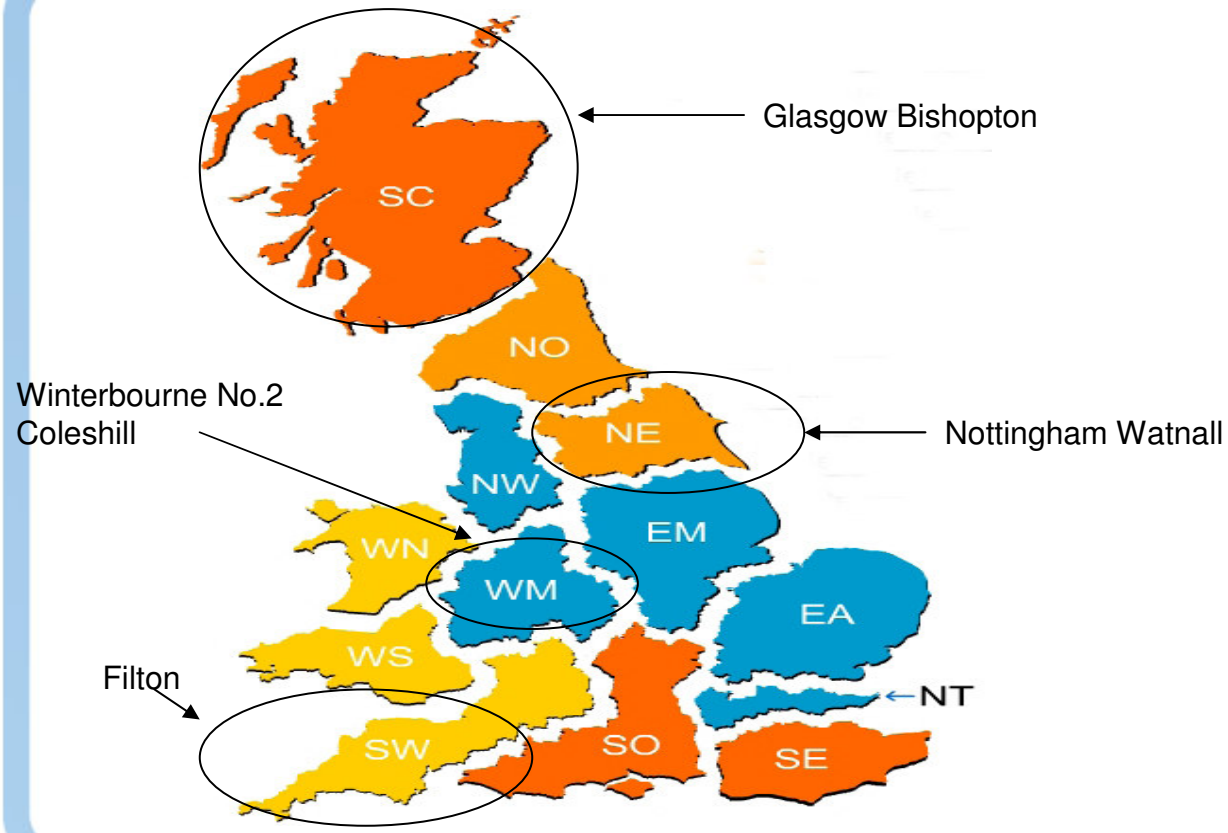
WSSM Weather Data Series 1960 to 2012: Data Missing relevant to CWV Parameters and 1 in 20 CWV Estimates

Weather Station	Temperature	Wind Speed	Comments
Glasgow	1965 to 1981 x 11	2007 x 1	
Albemarle	1960 to 1976 x 396	1985 to 2003 x 6	
Rostherne No.2	1960 to 1982 x 486	1985 to 2008 x 11	No Rostherne No.2 data from 30th Sep 2012 to 27th Oct 2013
Watnall	1961 to 1969 x 8	Complete	
Winterbourne No.2	1960 to 1982 x 52	n/a	Assumption for Temp Only
Coleshill	n/a	1985 x 1	Assumption for Wind Speed Only
St Athan	1960 to 1981 x 236	1985 x 1	
Heathrow	Complete	Complete	Issue with Wind Speed needs to be resolved first
Southampton	1961 to 1970 x 17,542	1998 to 1999 x 3	
Filton	1962 x 28	1985 to 1998 x 2	

Questions for TWG

- Trial Analysis – Q1:
  - Need to agree the number of years to include in CWV Optimisation Trial Analysis:
    - Option 1: Extend existing years to include 2012/13 (additional 4 years) so 1996/97 to 2012/13
    - Option 2: Add additional 4 years and remove 4 years so 2000/01 to 2012/13 ?
  - Cold weather upturn analysis continue to use data back to 1981/82 ?
  - Weather data series
    - Use the WSSM datasets from 01/10/1960 to 30/09/2012 ?
    - Fill in gaps using Gas Industry data ?
    - From 30/09/2012 to 30/09/2013 use data in S&M used to calculate CWVs ?
  - Need to agree the LDZs to be trialled ?
    - Xoserve suggestion on next slide based on weather stations with least amount of data missing

Trial LDZs ?



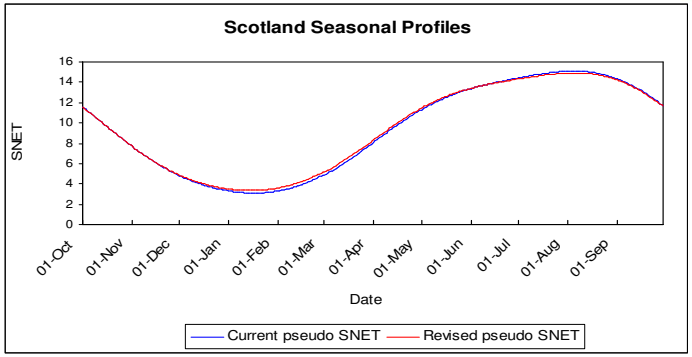
- These 4 weather stations have the least missing data which for trial purposes could be filled in with the daily temperatures and wind speeds from the gas industry weather series ?
- For main calculations later in the year we would like all WSSM data upto 30th Sep 12 filled in
- Suggested LDZs are SC, NE, WM and SW

Questions for TWG

- Trial Analysis – Q1:
  - 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
  - Results of analysis to be similar to that provided during last review, namely:
    - Assess average fit of CWVs to aggregate NDM demand
    - Assess average seasonal bias of aggregate NDM demand models using the mean percentage residual error (MPRE):
      MPRE = 100*(avg. actual demand – avg. fitted demand)
      avg. actual demand
      (for quarters Mar-May, Jun-Aug, Sep-Nov and Dec-Feb)
    - Assess change to 1 in 20 peak aggregate NDM demand estimates (using demand models and 1 in 20 peak CWVs)

Example Results Slide

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.63	0.656	0.0125	0.22	3	13.3	16.0	0.64
Revised	-4.19	0.653	0.0118	0.19	3	13.2	16.0	0.64



CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.69%	98.97%	6,218	-0.66%
Revised		3.68%	98.98%	6,196	
Current	2004/05 - 2008/09	3.84%	99.02%	6,338	-0.67%
Revised		3.80%	99.05%	6,258	

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.50%	-0.11%	4.03%	-0.41%	6.46%	-0.41%	4.13%	0.67%
Revised		2.48%	-0.10%	4.02%	-0.05%	6.53%	-0.52%	4.11%	0.35%
Current	2004/05-2008/09	2.58%	-0.10%	4.10%	-1.06%	7.74%	-0.30%	4.21%	1.21%
Revised		2.55%	-0.10%	4.01%	-0.68%	7.84%	-0.39%	4.14%	0.89%

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Next Steps

Next Steps

- Xoserve to publish document detailing approach to the CWV optimisation
- TWG to review document and provide feedback / answers to any outstanding questions within 1 week of publication date ?
- Shippers to provide signed-off methodology for data fill-in for both Temperature and Wind Speed – see Action for further details
- By the end of Trial analysis phase, Xoserve need to know the following:
  - Final decision on the number of years to include
  - All gaps in WSSM data series 1960 - 2012 filled in
  - Need to have agreed weather data to be used for GY 12/13 to 13/14