



Meter Under-Registration Analysis

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1 INTRODUCTION

South Staffs Water (SSW) has commissioned Servelec Technologies¹ to provide support in updating its Meter Under-Registration (MUR) estimates for the two regions operated by SSW: the South Staffordshire (SST) region and former Cambridge Water Company (CWC) region.

The existing MUR spreadsheet² has been updated for both the SST region and CWC regions based upon the current metering stock of SSW. This document provides details of the analysis.

The intended audience is Steve Colella and interested leakage management and water resources colleagues at SSW.

1.1 Objective

The objective of this work is to provide SSW with updated MUR estimates for the SST and CWC regions together with the supporting calculations.

MUR for the SST region was previously estimated following a programme of meter testing and subsequent analysis carried out during the period 2006-2011. The MUR estimates require updating for consistency with the current metering stock.

The CWC region has previously used long-standing MUR assumptions of 3% for measured households and 4% for measured non-households. These estimates also require updating based upon evidence from the SST region.

1.2 Data received

The following data were supplied by SSW in support of this project:

- Details of current metering stock in the SST and CWC regions, including meter types, meter sizes, serial numbers and install dates
- Forecast of new meter installations in the SST region for the period to 2045.

2 METER STOCK REVIEW

2.1 Install year and serial year

Overall, there appears to be a reasonable consistency between the meter install dates and the years based on the serial numbers. Where the serial number indicates a later year than the install date, it is assumed that a meter replacement has taken place and the year based upon the serial number is used.

In South Staffs, approximately 95.3% of meters installed between 1980 and 2017 have serial year numbers within 5 years from the assumed install date, as shown in Table 1 below.

¹ Tynemarch Systems Ltd trading as Servelec Technologies

² Meter Under-Registration Calculations Version 2.0, dated 14 January 2013

Assumed Install Year	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019
Serial Year 1980-84	22	26	5	19	19	28	10	
Serial Year 1985-89		23	6	19	6	6	8	
Serial Year 1990-94			4294	787	56	43	54	4
Serial Year 1995-99				15928	1856	74	98	6
Serial Year 2000-04					41188	4193	217	25
Serial Year 2005-09						58679	1898	48
Serial Year 2010-14							76095	1551
Serial Year 2015-19								25775

Table 1: Install Year vs Serial Year in South Staffs

In Cambridge, approximately 93.9% of meters installed between 1980 and 2017 have serial year numbers within 5 years of the install year as shown in Table 2.

Assumed Install Year	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019
Serial Year 1980-84	23	106	5	2	1		5	1
Serial Year 1985-89		2191	712	11	28	11	26	4
Serial Year 1990-94			6648	657	121	69	47	11
Serial Year 1995-99				30118	1016	104	98	32
Serial Year 2000-04					15518	718	94	24
Serial Year 2005-09						10950	891	14
Serial Year 2010-14							16106	1131
Serial Year 2015-19								9931

Table 2: Install Year vs Serial Year in Cambridge

Note that the figures above (for both South Staffs and Cambridge) are based on meters that are currently in use and have a diameter of up to 25mm. The majority of household meters will be in this range, and this will also cover small non-household meters where the MUR performance is likely to be similar to household meters.

Larger non-household meters may exhibit substantial MUR if proactive replacements have not been carried out. However there is insufficient information regarding the performance of meters with a diameter greater than 25mm to accurately report on their MUR.

2.2 Meter count by types and ages

The meter profiles in SST and CWC have been reviewed based on the meter types and ages. Household meters are on average newer than non-household meters in both regions. Again the review is based on meters that are currently in use and have a diameter of up to 25mm.

In South Staffs, installations on both households and non-households in the last seven years have tended to be Itron meters. Prior to that the bulk of installations were Kent meters, although there have been periods where substantial numbers of Sensus and Fusion meters have been installed. This is shown in Figure 1 and Figure 2.

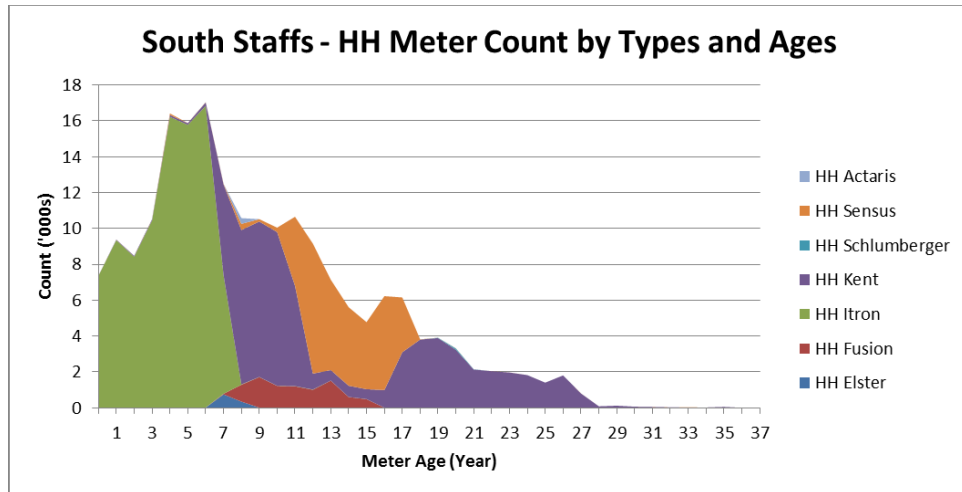


Figure 1: Meter age profiles for households in South Staffs

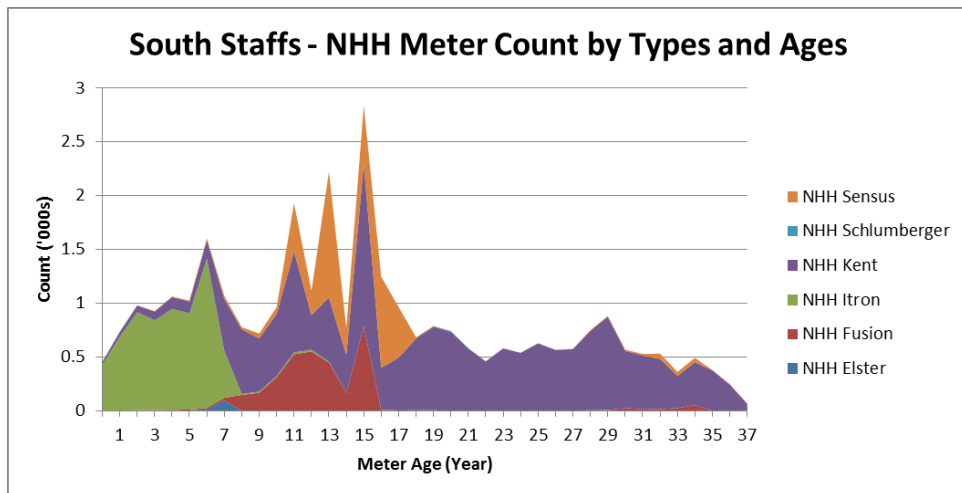


Figure 2: Meter age profiles for non-households in South Staffs

In Cambridge, Elster meters have been the main meter type for the last twenty years for both households and non-households. This is shown in Figure 3 and Figure 4.

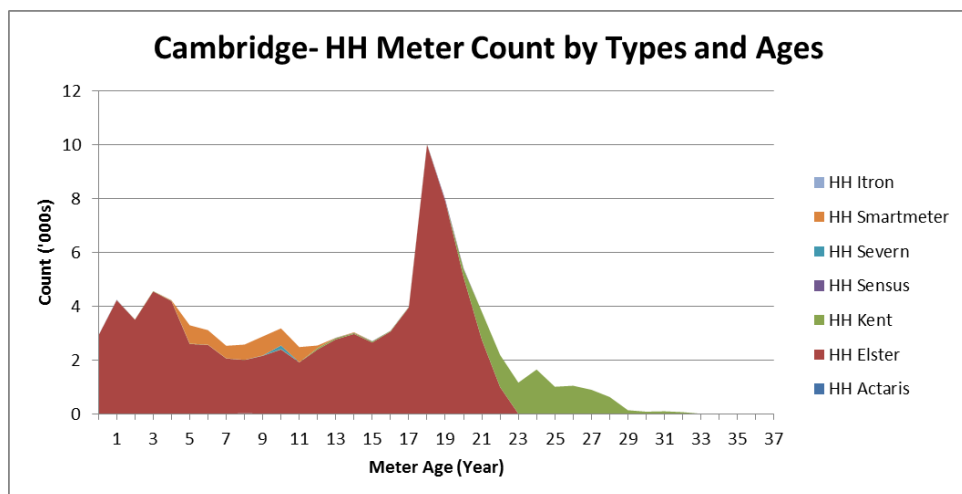


Figure 3: Meter age profiles for HH in Cambridge

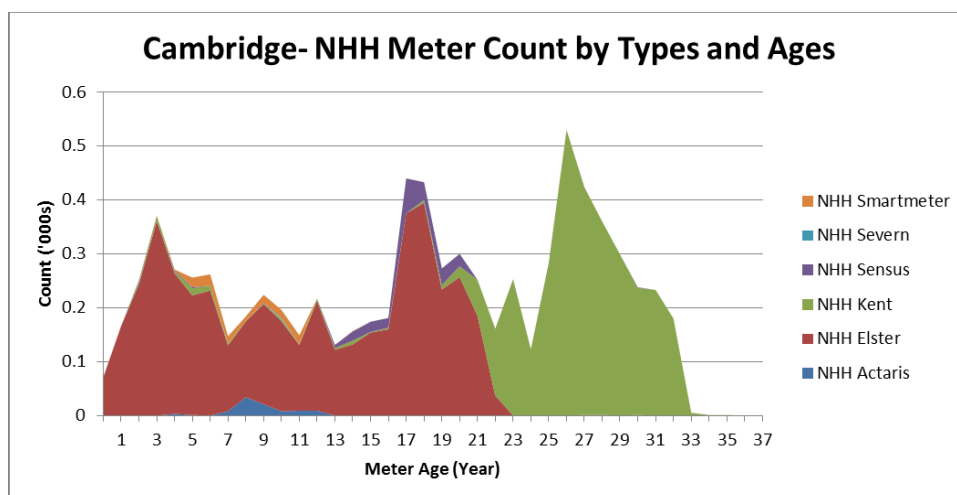


Figure 4: Meter age profiles for NHH in Cambridge

3 MUR ANALYSIS

3.1 Methodology

The MUR analysis has been updated based upon the following:

- Meters currently in use, with a diameter of up to 25mm, are included for both the South Staffs and Cambridge regions.
- Meter age is based on the install date provided for each meter. The review of the install dates against the dates based on the serial numbers is provided in Section 2.1, and shows that the install date and serial number derived date are reasonably aligned.
- The MUR allowance increases with meter age. The rate of meter deterioration is meter type specific (as detailed in the previous MUR report³).
- Some meter types were not present in the previous meter testing analysis. Assumptions for these meters are detailed in Appendix A.

The forecast MUR for a particular year is then found from the average MUR allowance of the contributing meters at their corresponding age.

3.2 Results

MUR results for each region are summarised in Table 3.

Region	Meters	Meter Count	Average Age	MUR (%)
South Staffs	Up to 25mm	235089	10.0	5.64
Cambridge	Up to 25mm	101981	13.2	6.92

Table 3: MUR estimates for each region

Note that the Cambridge MUR estimate assumes a 3% constant MUR for the STS Smartmeter. The results are not sensitive to this assumption. Increasing the STS Smartmeter assumption to a 9.5% constant MUR gives a result of 7.21% MUR for the Cambridge region.

³ Tynemarch Systems Ltd document ref: J0647\GD06\02, dated 21 July 2008

3.3 Forecast MUR profile

The annual MUR profiles (for households, non-households, or combined) for the horizon to 2030 are provided for both the SST and CWC regions. The numbers of new meters in the SST region were provided by SSW, whereas the numbers of new meters in the CWC region are assumed constant based on the levels observed in recent years.

The forecast MUR allowances for the SST and CWC regions under alternative replacement scenarios are shown in Figure 5 and Figure 6 respectively.

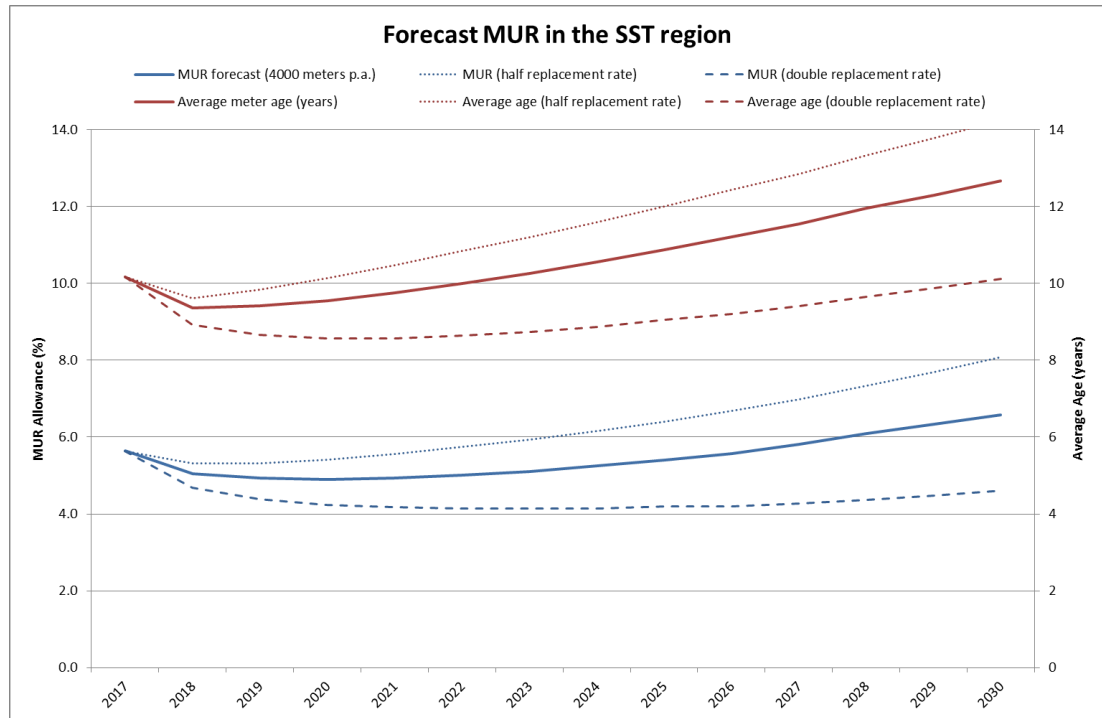


Figure 5: MUR profile in the SST region

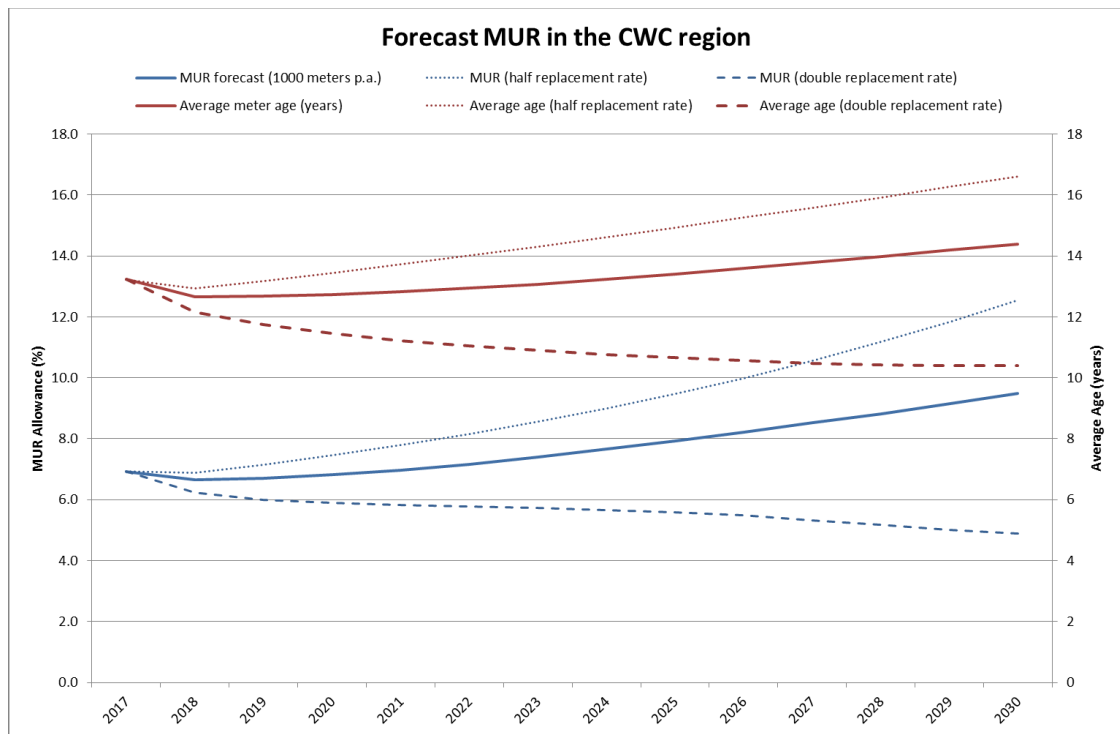


Figure 6: MUR profile in the CWC region

The MUR profiles are sensitive to the numbers of meter installations and meter replacements. Approximately 4,000 meters per annum in the SST region and over 1,000 meters per annum in the CWC region will require replacement during AMP7 in order to avoid increases in MUR.

4 CONCLUSIONS

The current MUR allowance for the South Staffs region combining household and non-household properties is 5.64%. The MUR allowance for the Cambridge region combining household and non-household properties is 6.92%.

Larger non-household meters may exhibit substantial MUR if proactive replacements have not been carried out. However there is insufficient information regarding the performance of meters with a diameter greater than 25mm to derive robust estimates of their MUR.

The forecast of MUR allowances over the period to 2030 is sensitive to the estimates for the numbers of new meters and meter replacements. SSW should ensure that these assumptions are as accurate as possible.

APPENDIX A. METER DETERIORATION ASSUMPTIONS

The following assumptions have been made regarding the deterioration of meters based upon their manufacturer:

Manufacturer	Deterioration curve used	Explanation
ABB	Elster	ABB is a previous brand name for Elster meters
Actaris	Schlumberger	Actaris is a subsequent brand name for Schlumberger meters
Elster	Elster	Deterioration curve developed in previous analysis
Fusion	Sensus	Fusion meters were installed during a similar period to Sensus meters and assumed to exhibit similar performance
Itron	Elster	The Itron meters are modern meters and therefore the curve showing least MUR was considered appropriate
Kent	Elster	Kent is a previous brand name for Elster meters
Schlumberger	Schlumberger	Deterioration curve developed in previous analysis
Sensus	Sensus	Deterioration curve developed in previous analysis
Severn	See below	See below
Smartmeter	See below	See below

The descriptions Severn and Smartmeter refer to the internal SM150 and SM150E meters manufactured by Severn Trent Systems (STS). The lack of moving parts in the STS meters means that they are thought not to deteriorate substantially with age.

There is some evidence that small electronic meters suffer from the issue of a high starting flow that means they do not record ball-valve tails, dripping taps, etc. MUR from these meters can therefore be significant.

The public domain commentaries for Severn Trent Water during 2008-10 confirms the allowance made for "small electronic meters" as 23 l/prop/d plus an additional 6 l/prop/d for plumbing losses not recorded by standard customer meters. The text also suggests that these are based upon analysis of a SE100 meter rather than the SM150 used in the Cambridge region, but are applied to all small electronic meters installed.

It has been assumed that a 3% constant MUR is applicable for the STS meters used within the Cambridge region, since results from physical testing are unavailable.

A total of 29 l/prop/d based upon the Severn Trent Water reported findings would be equivalent to 9.5% MUR for the Cambridge region. The sensitivity of increasing the MUR assumption to this value has therefore been investigated.

APPENDIX B. DETAILED RESULTS

For the South Staffs region, the results for 2017 are 4.79% MUR for households and 10.86% MUR for non-households with a meter diameter of up to 25mm. The combined result for all properties, households and non-household, is 5.64%. This is summarized in Table 4.

Region	Properties	Meter Count	Average Age	MUR (%)
South Staffs	All (up to 25mm)	235089	10.0	5.64
South Staffs	HH	202100	9.2	4.79
South Staffs	NHH (up to 25mm)	32989	15.1	10.86

Table 4: MUR estimates in the South Staffs region

For the Cambridge region, the results for 2017 are 6.48% MUR for households and 11.96% MUR for non-households with a meter diameter of up to 25mm. The combined result is 6.92%, as shown in Table 5.

Region	Properties	Meter Count	Average Age	MUR (%)
Cambridge	All (up to 25mm)	101981	13.2	6.92
Cambridge	HH	93756	12.9	6.48
Cambridge	NHH (up to 25mm)	8225	17.3	11.96

Table 5: MUR estimates in the Cambridge region

Note that the above numbers assume a 3% constant MUR for the STS Smartmeter, since this type is not present in the South Staffs region and results from physical testing are unavailable. However the results are not sensitive to this assumption. Increasing the STS Smartmeter assumption to a 9.5% constant MUR gives results for the Cambridge region of 6.79% for households, 12.05% for non-households, and 7.21% overall.

The estimated MUR allowance for households is generally lower than those for non-households. This is consistent with the lower average age of household meters as shown in the meter stock review in Section 2.2.