

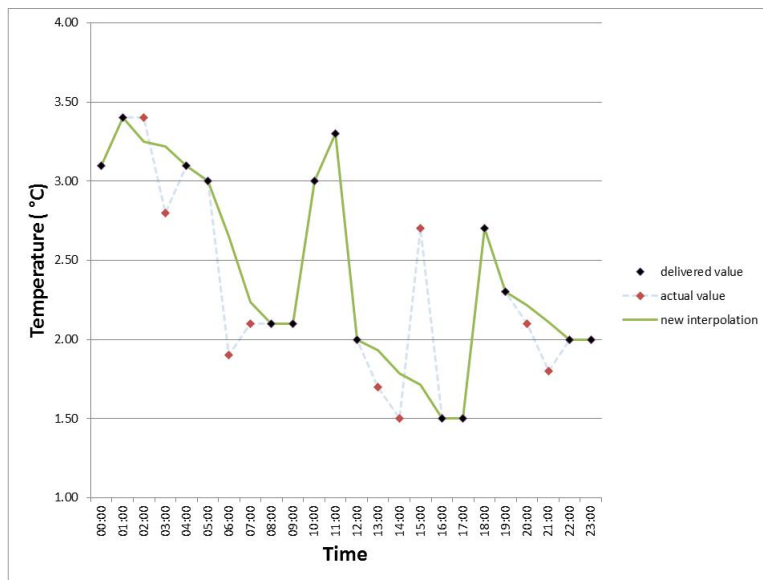
## DESC Technical Workgroup action DTW0301

At the DESC Technical workgroup on 25<sup>th</sup> March E.ON was asked to provide some validation on the gap filling methodology proposed along with documentation on the methodology.

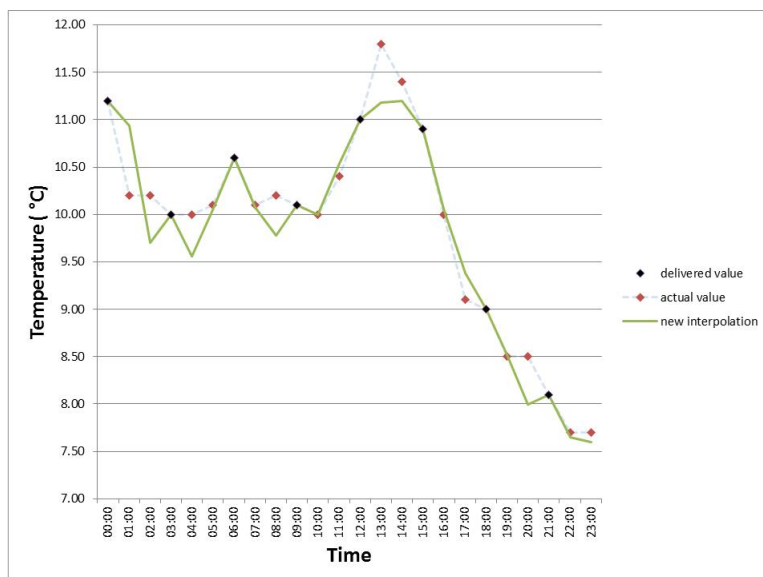
We have used four days across the period for Southampton weather station temperature information. Over these four days we have removed various points and utilised the proposed mechanism to fill the gaps. The accuracy has then been measured between the interpolation and the actual delivered values.

The values are included as an Appendix. The charts for the four days are below:

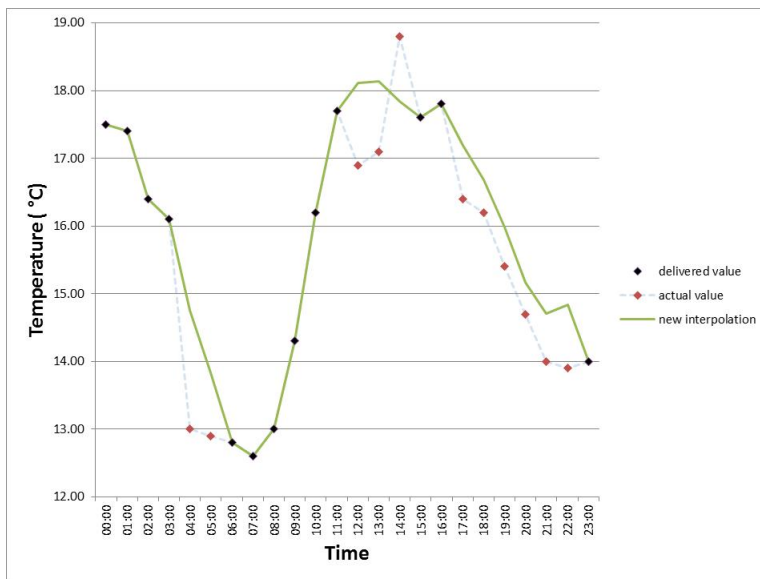
### 15<sup>th</sup> March 1979



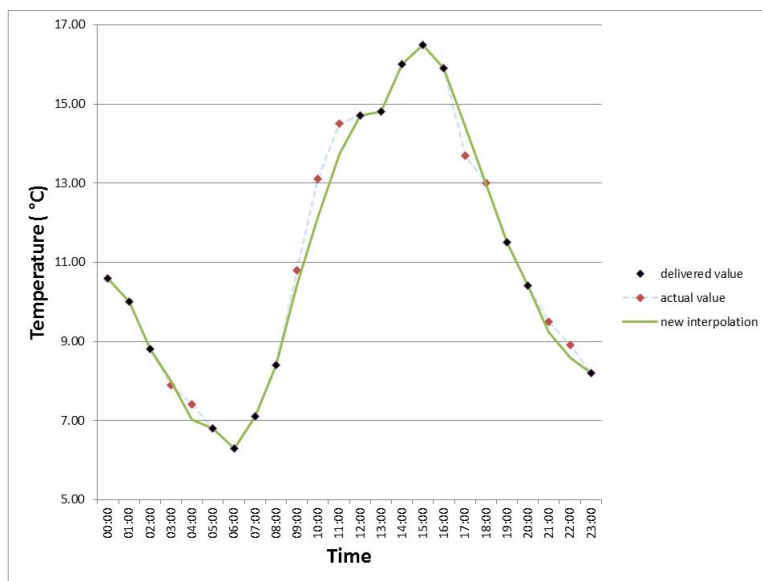
### 31<sup>st</sup> December 1987



## 22<sup>nd</sup> September 1991



## 7<sup>th</sup> April 2007



As can be seen from the graphics the interpolation generally follows the underlying shape. Where the weather has been smooth – as per the final chart – the fit is better than where there are more sudden deviations. It is difficult to find a simple mechanism that would provide a perfect fit. The MAPE of the fitted to actual values in our four examples is 6.6% across the 45 removed values.

The methodology utilised is described below:

For each variable and weather station combination create an Expected Value matrix for each hour/day combination by a simple average across all values available from 1/1/1980 to 30/9/2013 inclusive.

Gap fill as follows:

1. Increase both expected and delivered values by 100.
2. Calculate the “straight line” interpolation for each intervening hour between the supplied variables delivered for weather times A and B.
3. Find the Expected Values at the Weather Times A and B, and then calculate a “straight line” interpolation for each intervening hour between these points.
4. Calculate the % variance (positive or negative) of the loaded normal hourly values against this straight line interpolation for each intervening hourly period.
5. The half hourly variance % is then applied to the “straight line” values from step 2 to give the moving interpolation. This can be capped at a max and min (e.g. 9 and 0 for cloud).
6. Decrease values by 100

Numerically, this is below:

Expected values (a)	delivered values (b)	Hourly interval (c)	"straight line" expected (d)	deviance from straight line (e)	straight line delivered points (f)	New interpolation (g)
X	A	0	$=X+(Y-X)/2*0$	$=1-(d-a)/a$	$=A+(B-A)/2*0$	$=e*f$
Y	B	1	$=X+(Y-X)/2*1$	$=1-(d-a)/a$	$=A+(B-A)/2*1$	$=e*f$
5.833	6.000	0	5.833	1.000	6.000	6.000
5.500		1.000	5.833	0.943	5.500	5.186
5.167		2.000	5.833	0.886	5.000	4.429
5.083		3.000	5.833	0.871	4.500	3.921
5.000		4.000	5.833	0.857	4.000	3.429
5.417		5.000	5.833	0.929	3.500	3.250
5.833	3.000	6.000	5.833	1.000	3.000	3.000

**Appendix – Interpolated and Actual values**

<b>date</b>	<b>hour</b>	<b>expected series</b>	<b>actual value</b>	<b>delivered value</b>	<b>new interpolation</b>
15/03/1979	00:00	6.87	3.10	3.10	3.10
15/03/1979	01:00	6.82	3.40	3.40	3.40
15/03/1979	02:00	6.53	3.40		3.25
15/03/1979	03:00	6.48	2.80		3.22
15/03/1979	04:00	6.25	3.10	3.10	3.10
15/03/1979	05:00	6.24	3.00	3.00	3.00
15/03/1979	06:00	6.31	1.90		2.65
15/03/1979	07:00	6.19	2.10		2.23
15/03/1979	08:00	6.81	2.10	2.10	2.10
15/03/1979	09:00	7.80	2.10	2.10	2.10
15/03/1979	10:00	8.83	3.00	3.00	3.00
15/03/1979	11:00	9.47	3.30	3.30	3.30
15/03/1979	12:00	10.17	2.00	2.00	2.00
15/03/1979	13:00	10.67	1.70		1.93
15/03/1979	14:00	10.70	1.50		1.78
15/03/1979	15:00	11.29	2.70		1.71
15/03/1979	16:00	10.83	1.50	1.50	1.50
15/03/1979	17:00	10.37	1.50	1.50	1.50
15/03/1979	18:00	9.54	2.70	2.70	2.70
15/03/1979	19:00	8.74	2.30	2.30	2.30
15/03/1979	20:00	8.38	2.10		2.21
15/03/1979	21:00	7.94	1.80		2.11
15/03/1979	22:00	7.49	2.00	2.00	2.00
15/03/1979	23:00	7.08	2.00	2.00	2

<b>date</b>	<b>hour</b>	<b>expected series</b>	<b>actual value</b>	<b>delivered value</b>	<b>new interpolation</b>
31/12/1987	00:00	5.92	11.20	11.20	11.20
31/12/1987	01:00	6.11	10.20		10.94
31/12/1987	02:00	5.76	10.20		9.70
31/12/1987	03:00	6.26	10.00	10.00	10.00
31/12/1987	04:00	5.73	10.00		9.56
31/12/1987	05:00	5.73	10.10		10.05
31/12/1987	06:00	5.75	10.60	10.60	10.60
31/12/1987	07:00	5.65	10.10		10.07
31/12/1987	08:00	5.66	10.20		9.77
31/12/1987	09:00	6.02	10.10	10.10	10.10
31/12/1987	10:00	6.16	10.00		10.00

31/12/1987	11:00	6.67	10.40		10.54
31/12/1987	12:00	7.15	11.00	11.00	11.00
31/12/1987	13:00	7.33	11.80		11.18
31/12/1987	14:00	7.40	11.40		11.20
31/12/1987	15:00	7.26	10.90	10.90	10.90
31/12/1987	16:00	6.75	10.00		10.06
31/12/1987	17:00	6.34	9.10		9.38
31/12/1987	18:00	6.12	9.00	9.00	9.00
31/12/1987	19:00	5.91	8.50		8.52
31/12/1987	20:00	5.68	8.50		8.00
31/12/1987	21:00	5.86	8.10	8.10	8.10
31/12/1987	22:00	5.66	7.70		7.65
31/12/1987	23:00	5.74	7.70		7.60

date	hour	expected series	actual value	delivered value	new interpolation
22/09/1991	00:00	13.67	17.50	17.50	17.50
22/09/1991	01:00	13.32	17.40	17.40	17.40
22/09/1991	02:00	12.83	16.40	16.40	16.40
22/09/1991	03:00	12.97	16.10	16.10	16.10
22/09/1991	04:00	12.61	13.00		14.75
22/09/1991	05:00	12.60	12.90		13.84
22/09/1991	06:00	12.51	12.80	12.80	12.80
22/09/1991	07:00	12.60	12.60	12.60	12.60
22/09/1991	08:00	13.55	13.00	13.00	13.00
22/09/1991	09:00	15.24	14.30	14.30	14.30
22/09/1991	10:00	16.12	16.20	16.20	16.20
22/09/1991	11:00	17.20	17.70	17.70	17.70
22/09/1991	12:00	17.76	16.90		18.11
22/09/1991	13:00	17.93	17.10		18.13
22/09/1991	14:00	17.78	18.80		17.85
22/09/1991	15:00	17.67	17.60	17.60	17.60
22/09/1991	16:00	16.88	17.80	17.80	17.80
22/09/1991	17:00	16.29	16.40		17.19
22/09/1991	18:00	15.80	16.20		16.68
22/09/1991	19:00	15.14	15.40		15.99
22/09/1991	20:00	14.36	14.70		15.16
22/09/1991	21:00	13.91	14.00		14.70
22/09/1991	22:00	14.03	13.90		14.83
22/09/1991	23:00	13.22	14.00	14.00	14

date	hour	expected series	actual value	delivered value	new interpolation
07/04/2007	00:00	7.40	10.60	10.60	10.60
07/04/2007	01:00	6.95	10.00	10.00	10.00

<b>07/04/2007</b>	<b>02:00</b>	6.79	8.80	8.80	8.80
<b>07/04/2007</b>	<b>03:00</b>	6.43	7.90		7.99
<b>07/04/2007</b>	<b>04:00</b>	5.94	7.40		7.02
<b>07/04/2007</b>	<b>05:00</b>	6.05	6.80	6.80	6.80
<b>07/04/2007</b>	<b>06:00</b>	6.04	6.30	6.30	6.30
<b>07/04/2007</b>	<b>07:00</b>	6.51	7.10	7.10	7.10
<b>07/04/2007</b>	<b>08:00</b>	7.52	8.40	8.40	8.40
<b>07/04/2007</b>	<b>09:00</b>	8.68	10.80		10.43
<b>07/04/2007</b>	<b>10:00</b>	9.54	13.10		12.13
<b>07/04/2007</b>	<b>11:00</b>	10.32	14.50		13.74
<b>07/04/2007</b>	<b>12:00</b>	10.61	14.70	14.70	14.70
<b>07/04/2007</b>	<b>13:00</b>	11.14	14.80	14.80	14.80
<b>07/04/2007</b>	<b>14:00</b>	11.30	16.00	16.00	16.00
<b>07/04/2007</b>	<b>15:00</b>	11.47	16.50	16.50	16.50
<b>07/04/2007</b>	<b>16:00</b>	11.39	15.90	15.90	15.90
<b>07/04/2007</b>	<b>17:00</b>	10.94	13.70		14.42
<b>07/04/2007</b>	<b>18:00</b>	10.51	13.00		12.97
<b>07/04/2007</b>	<b>19:00</b>	10.07	11.50	11.50	11.50
<b>07/04/2007</b>	<b>20:00</b>	9.54	10.40	10.40	10.40
<b>07/04/2007</b>	<b>21:00</b>	8.66	9.50		9.23
<b>07/04/2007</b>	<b>22:00</b>	8.24	8.90		8.59
<b>07/04/2007</b>	<b>23:00</b>	8.07	8.20	8.20	8.2