EVALUATION OF ALGORITHM PERFORMANCE – 2012/13 GAS YEAR SCALING FACTOR AND WEATHER CORRECTION FACTOR

1.0 Background

The annual gas year algorithm performance evaluation normally considers three sources of information as follows:

- daily values of scaling factor (SF) and weather correction factor (WCF)
- reconciliation variance data for each end user category (EUC)
- daily consumption data collected from the NDM sample

The material presented here refers only to SF and WCF data. The other strands of this evaluation will be available for consideration at a subsequent DESC meeting.

At the outset, it is worth setting out the characteristics of the key variables: the scaling factor (SF) and the weather correction factor (WCF).

The SF is a multiplier used to ensure that within each LDZ, aggregate NDM allocations equal total actual NDM demand. The ideal value of the SF is one, but variations may occur for a number of reasons including imperfections in the algorithms, but also errors in aggregate AQs and in measured LDZ and DM consumption (because aggregate NDM consumption is determined by difference: i.e. LDZ consumption-DM consumption), and deviations in aggregate NDM demand in the LDZ under average weather conditions away from the sum (for all end user categories (EUCs) in the LDZ) of Annual Load Profile (ALP) weighted daily average consumption based on EUC AQs. If other factors (most notably AQs) are not material, a scaling factor of less than one indicates a tendency of the NDM profiling algorithms to over allocate.

Up to the end of gas year 2007/08, the WCF represented the extent to which actual aggregate NDM demand in the LDZ differed from the forecast (before the year) seasonal normal demand (SND) for aggregate NDM in the LDZ. When actual aggregate NDM demand equalled seasonal normal demand, then WCF was zero. Typically, demand would have been above SND when it was colder than normal and below SND when it was warmer, and the WCF responded accordingly. However, if there had been an unforeseen growth in demand, then this would have been reflected in generally higher values of WCF than implied by the weather alone. Similarly, if demand had been unseasonably depressed (e.g. with early heating load switch-off or sustained demand loss due to high energy prices), then the WCF would have taken on a value lower than that expected solely due to the weather.

As a result of adoption of UNC Modification 204, the WCF applied from the start of gas year 2008/09 was redefined. WCF is now the extent to which actual aggregate NDM demand in the LDZ differs from the sum for all EUCs of ALP weighted daily average consumption based on EUC AQs in each LDZ. In the computation of WCF, the sum of ALP weighted daily average consumption for all EUCs in each LDZ (based on EUC AQs at the start of the gas year and potentially subject to revision periodically within the gas year) replaced year ahead forecast aggregate NDM SND in each LDZ. Broadly, WCF is still expected to take on positive values under conditions of cold weather and negative values under conditions of warm weather. Moreover, the effect on WCF of unforeseen growth in demand or unseasonably depressed demand would also broadly remain the same as before, with WCF respectively taking on higher or lower values than otherwise in these instances. However, the sum of ALP weighted daily average consumption for all EUCs in a LDZ is clearly not the same as a forecast value of aggregate NDM SND in the LDZ. Thus, the effect on WCF of unforeseen growth in demand or unseasonably depressed demand is now less clear. An excess in EUC AQs would tend to depress WCF and a deficit would tend to inflate WCF from the values it would otherwise have taken. So, UNC Modification 204 has replaced one potential source of error in the WCF calculation with another.

Up to the end of gas year 2007/08, any bias in WCF caused by seasonal normal demands for aggregate NDM in the LDZ being under or overstated would be observed by monitoring the quantity WCF-EWCF. The EWCF (estimated weather correction factor) is calculated directly from the demand model for aggregate NDM in the LDZ and captures the effects of weather alone on demand. The difference between WCF and EWCF thus isolates the non-weather component of the WCF. From 1st October 2008 onwards, WCF-EWCF merely reflects the difference between actual NDM demand relative to ALP weighted daily average demand (based on EUC AQs) and computed NDM demand relative to NDM SND. The EWCF (derived from a demand model for aggregate NDM as before) still captures the impact of weather alone on demand, but, for gas years 2008/09 onwards, the difference WCF-EWCF is no longer a measure of bias in the WCF due to SND for aggregate NDM in the LDZ being under or overstated. An equivalent measure to WCF-ECWF that captures the bias in the new definition of WCF due to EUC AQ error cannot be formulated, since there is no means of separately and differently computing in a manner free of EUC AQ error, the sum for all EUCs of ALP weighted daily average consumption based on EUC AQs in each LDZ.

Figures 1 to 13 show graphs of the daily values of SF and WCF for each LDZ for two whole gas years 2011/12 and 2012/13. It should also be noted that SF and WCF values have also been obtained for the period 1st to 10th October 2013 (the start of the new gas year 2013/14) and appended to the graphs of the previous two completed gas years. Tables of average values of SF, WCF-EWCF and WCF, for gas years 2011/12 and 2012/13, along with the improvement or degradation in these averages between the two gas years, are presented in Tables 1 to 9. The root mean square (RMS) deviation of SF from 1 has also been computed for each discrete month during the previous gas years 2011/12 and 2012/13, and the respective figures can be found in Tables 10 and 11. The differences in these RMS values between the two gas years are presented in Table 12. These figures provide a very useful measure of the variability of SFs about one (the ideal value). In addition, Tables 13 and 14 provide monthly values of weather corrected NDM demand expressed as a percentage of aggregate NDM seasonal normal demand (SND) for each month of gas years 2011/12 and 2012/13 respectively.

2.0 Overall Results

These various graphs and tables indicate the following notable points:

- During gas year 2011/12 average SF values were less than or equal to one (over days of the week, Saturdays and winter) in all LDZs. During gas year 2012/13 average SF values were less than or equal to one (over Mondays to Thursdays, Fridays, weekend days and summer) in 9 out of 13 LDZs.
- For 10 out of 13 LDZs on Mondays to Thursdays, and 6 out of 13 LDZs on Fridays and Saturdays, average values of SF were improved in 2012/13 (i.e. were closer to one) compared to the previous gas year (2011/12). WS LDZ showed deterioration from the previous gas year on all days of the week, SC, NE, EA and NT were the same on Sundays. Also, LDZs NW, EM and WM all displayed deterioration over Fridays, Saturdays and Sundays.
- Over the winter period of 2012/13 average values of SF were closer to the ideal value of one than over the winter period of the previous gas year (2011/12) in all 13 LDZs.
- Average SF values for all of summer 2012/13 showed deterioration over summer 2011/12 in 10 out of 13 LDZs, with the smallest deterioration being 0.001 (in LDZs NO and EA) and largest being 0.016 (in LDZ SC).
- The RMS deviation of SF from the ideal value of one provides a measure of the variability of SFs. During winter 2012/13, October 2012 was colder than the current seasonal normal basis (the 9th coldest in the last 50 years) with November 2012 was slightly colder than seasonal normal. December 2012 was a mixed month (the first half of the month being much colder than current seasonal normal and the second half being generally warmer) resulting in it being ranking as the 22nd coldest in the last 50 years. January 2013 was also mixed with the beginning and end of the month being much warmer than seasonal normal and the middle of the month being much colder than seasonal normal. February 2013 was colder than season normal (ranking as 16th coldest in the last 50 years) and March 2013 was much colder that seasonal normal (the 2nd coldest in the last 50 years). During the generally colder than normal winter period (October to March) of gas year 2012/13, in almost all LDZs in each individual month, the RMS deviation of SF from the ideal value of one was notably lower (i.e. improved) compared to the corresponding periods of the previous gas year. A few exceptions were limited to WM and WN LDZs in the month of December and NW LDZ in January.
- RMS deviations of SF from the ideal value of one exhibited a somewhat mixed picture during the summer period (April to September) of gas year 2012/13. For each of the summer months, in a majority (7 or more out of 13) of LDZs and overall across all LDZs, the RMS deviation of SF from the ideal value of one showed improvement compared to the corresponding months of the previous gas year (2011/12). The summer period of gas year 2012/13 was, overall, slightly colder than seasonal normal. April 2013 started off colder than seasonal normal but became milder towards the later half of the month (ranking 10th coldest in the last 50 years). The month of May 2013 started off with a week of mild weather ending with a few weeks of notable colder periods. Despite having a few warmer days, June 2013 was generally colder than normal. July 2013 began with a short, 3 day period of particularly colder weather but the remainder of the month experienced consistently warmer than normal temperatures making it the 3rd warmest July in the last 50 years. August 2013, in general, was predominantly warmer than normal and despite a few colder days it ranked as 9th warmest August in last 50 years. September 2013 was a mixed month with the beginning and end of the month being

warmer than seasonal normal and a two week period of notably colder than normal weather in the middle of the month.

- Considered overall SFs during 2012/13 generally were less variable than over the previous gas year.
- Examination of the average weekday and weekend day values of WCF-EWCF in Tables 4, 5 and 6 indicates that the deviation of WCF from EWCF, appeared to be less marked (i.e. closer to zero) for 3 LDZs (EM, SE and SO) and more marked (i.e. further from zero) for 2 LDZs (namely NE and NT), compared to that over the equivalent days of the previous gas year. For winter 2012/13 as a whole the deviation of WCF from EWCF was more marked than for winter 2011/12 in 7 LDZs. For summer 2012/13 as a whole the deviation of WCF from EWCF was less marked over that for summer 2011/12 in all but 3 LDZs (namely SC, NO and NT). However, as previously explained WCF-EWCF is no longer a measure of bias in the WCF due to SND for aggregate NDM in the LDZ being under or overstated.
- WCF is the difference between actual aggregate NDM demand and ALP weighted daily average consumption in each LDZ (based on EUC AQs) divided by the ALP weighted daily average consumption in each LDZ. During gas year 2011/12 average WCF values were positive for all LDZs on Fridays, Saturdays and Sundays (except for 2 LDZs on Fridays and 1 LDZ on Saturdays) and for all LDZs during the summer period, but were negative for 9 out of 13 LDZs on Mondays to Thursdays and all LDZs in the winter period (See Table 7). Negative values can be caused by factors such as the EUC AQs being too high or by the weather being warmer than seasonal normal.
- During gas year 2012/13 average WCF values were positive for all LDZs on Mondays to Thursdays, Fridays, Saturdays and Sundays. During the winter and summer periods the average WCF values were also positive for all LDZs (See Table 8). Positive values can be caused by factors such as EUC AQs being too low or by weather being colder than seasonal normal.
- WCF was further away from zero in 2012/13 than in 2011/12 on Mondays to Thursdays, Fridays, Saturdays and Sundays in all LDZs (see Table 9). In winter 2012/13 WCF was further away from zero in all LDZs, but was closer to zero in summer 2012/13 in 10 LDZs. The differences between the years are the result of differences in factors such as weather or EUC AQ inaccuracies.
- There was no notable step change in WCF values following implementation of revised pseudo SND values on 1st January 2013 (LDZ WN) and 1st July 2013 (LDZs SC, SW & SO). However, it is feasible that the unseasonably warm weather in July 2013 may have somewhat ‘masked’ any notable step change in WCF values as a result of the revised pseudo SND values.
- Comparison of weather corrected aggregate NDM demand as a percentage of aggregate NDM SND in 2011/12 (Table 13) and 2012/13 (Table 14) indicates that for the majority of the month/LDZ combinations in the winter months the percentages for 2012/13 are higher than those for 2011/12. This suggests that relative to observed demand on a weather corrected basis, the SND values that applied (for computing DAFs for example) in 2012/13 were generally lower than in 2011/12. In contrast the opposite was true for the majority of the summer months where the percentages for 2012/13 are lower than those for 2012/13. This suggests that relative to observed demand on a weather corrected basis, the SND values that applied in the summer of 2012/13 were generally higher than in 2011/12.

3.0 Commentary

It is customary in this note on WCF and SF values to identify and provide a commentary on any unusual occurrences of SF and WCF-EWCF values, in the most recent gas year (2012/13). This is not a comprehensive set of all observed perturbations, instead it is a set of the more marked instances along with examples of typical cases:

- Overall October 2012 was the 9th coldest October in the last 50 years and, according to the Met Office, was the coldest October since 2003. However, there were some warm days around 22nd to 24th and during this period, aggregate NDM demand was reduced in most LDZs resulting in slightly negative WCF values and corresponding small decreases in SF. During the last 6 days of the month (26th to 31st) the weather was particularly cold with the 27th being the coldest. During this 6 day period, inflated aggregate NDM demand in all LDZs resulted in sharply positive WCF values
- The month of November 2012 was just below the current seasonal normal basis overall and around the average for the last 50 years. There were some notable periods of cold weather in all LDZs from approximately 1st to 6th and 28th to 30th (the last two days of the month also saw snowfall in the north of the UK). During these cold periods, aggregate NDM demand increased, resulting in sharply positive WCF values in all LDZs. In contrast, the middle part of the month was generally warmer than normal particularly around 13th, 14th and 20th, resulting in depressed aggregate NDM demands and negative

WCF values in all LDZs during these warm days (with SF values falling below the ideal value of one in most LDZs).

- December 2012 began with an extended cold spell during the first 14 days which saw wintery showers bringing some snow to the north and east of the UK. As a result, aggregate NDM demand increased forcing WCF values to be sharply positive in all LDZs during this period. While an increased WCF value acts on SF to depress its value, the direct effect of elevated NDM demand on SF is to increase its value. In all LDZs this direct effect was predominant leading to corresponding but much smaller increases in SF on these coldest days. The second half of the month was warmer than normal and during this milder period total NDM demand was depressed, resulting in negative WCF values on most days. While the reduction in WCF would have tended to increase the SF, the direct effect on the SF of the reduced total NDM demand resulted in small decreases in the SF during this period in most LDZs.
- The month of January 2013 was one of some contrasts but overall was around the average for the last 50 years. The month began with very mild conditions with temperatures significantly above average for the time of year. The period from 2nd to 8th was unseasonably warm and as a result, aggregate NDM demand was depressed leading to negative WCF values in all LDZs on these days. By mid month it had turned significantly colder and there were periods of significant snowfall across most of the country between the 18th & 25th (the heaviest snowfall occurred in LDZ WS on 18th January). During this period, inflated aggregate NDM demand resulted in sharply positive WCF values. Despite the temperature during the last few days of the month being warmer than normal, much of the UK experienced strong or severe gales.
- Overall, the month of February 2013 was much colder than the current seasonal normal, continuing the cold theme of December and January. It was the 16th coldest February in the last 50 years and it was particularly cold in the periods from the 5th to 13th and 20th to 28th. During these periods, aggregate NDM demand was increased, resulting in sharp positive WCF values in most LDZs.
- March 2013 was the 2nd coldest March in the last 50 years. Unusually, the month experienced substantial late-season snowfalls in certain areas from 6th to 27th and it was especially cold during the second half of the month. During this extended cold period, inflated aggregate NDM demand in all LDZs resulted in sharply positive WCF values (most clearly seen in SO LDZ). While an increase in WCF value acts on SF to depress its value, the direct effect of elevated aggregate NDM demand on SF is to increase its value. In all LDZs this direct effect was predominant leading to corresponding but much smaller increases in SF on these coldest days.
- Overall, the month of April 2013 ranked as being the 10th coldest April in the last 50 years. The month started particularly colder than normal but became milder as the month went on. There were, however, some warm days from 14th to 17th and 24th to 25th (particularly in the east) which resulted in depressed aggregate NDM demands in most LDZs and reduced WCFs on these days (most clearly seen in EA LDZ). While a reduced WCF would act on SF to increase its value, the direct effect of depressed aggregate NDM demand on SF is to decrease its value. In most LDZs this direct effect was predominant leading to corresponding but smaller decreases in SF on these days. Conversely on the coldest days of the month (around 1st to 4th), the WCF was strongly positive with a corresponding small increase in SF values on these days.
- The month of May 2013 was slightly colder than the current seasonal normal basis overall, continuing the cool theme which characterised spring. The month started slightly colder than normal followed by some warm days around 6th to 8th May. On these warm days most LDZs displayed negative WCF values. A corresponding decrease in SF in most LDZs is also observed over these warm days of the month, particularly on the 7th. While a reduced WCF would act on SF to increase its value, the direct effect of depressed aggregate NDM demand on SF is to decrease its value and this appears to have been the predominant effect on these days. The remainder of May was generally colder than normal, particularly around 13th to 16th and 23rd to 24th, resulting in inflated aggregate NDM demands and positive WCF values in all LDZs, with SF values raising above one on these days in all LDZs (except SC LDZ on 24th).
- Overall, June 2013 was slightly cooler than the current seasonal normal basis and around the average over the last 50 years. The month began settled and, according to the Met Office, temperatures barely exceeded their seasonal averages over England whereas western parts of Scotland was slightly warmer than average. The remaining 3 weeks of the month were colder than the current seasonal normal (especially in the south-east) although there was a brief warm spell from 18th to 21st. During this colder period, inflated aggregate NDM demand resulted in sharply positive WCF values in most

LDZs (most notable in EA, NT & SE LDZs around the 9th). An increased WCF value acts on SF to reduce its value, but again the direct effect on the SF of increased total NDM demand resulted in a corresponding but smaller increase in SF in most LDZs.

- Overall, July 2013 ranked as the 3rd warmest July over the last 50 years. The month began with a short period (1st to 4th) of colder than normal temperatures. The remainder of the month saw temperatures creep high above seasonal normal, particularly the period from 6th to 24th, such that the max CWV value was achieved on most days in each LDZ during this period. According to the Met Office, this was the UK's most notable heat wave since 2006. During this extended warm period reduced aggregate NDM demand resulted in negative WCF values in most LDZs.

- The month of August 2013 was slightly warmer than the current seasonal normal basis overall, ranking as the 9th warmest August in the last 50 years. It was particularly warm in the periods from the 1st to 3rd and 21st to 30th. During these periods aggregate NDM demand was depressed, resulting in negative WCF values in most LDZs. Conversely on the coldest days of the month (around 13th), the WCF was strongly positive with a corresponding small increase in SF values on these days.

- Overall, September 2013 was slightly colder than the current seasonal normal basis and around average for the last 50 years. The majority of the month (6th to 20th) saw colder than normal temperatures with particularly cold weather occurring during the period of the 14th to 20th. During this particularly cold spell, inflated aggregate NDM demand resulted in sharply positive WCF values. While the increase in WCF would have tended to depress the SF, the direct effect on the SF of the increased aggregate NDM demand resulted in a corresponding increase in the SF in most LDZs (except NT). The remainder of the month (22nd to 30th) saw temperatures creep above seasonal normal, resulting in reduced aggregate NDM demands, resulting in negative WCF values (and corresponding small reductions in SF) in most LDZs.

  In WS LDZ on 4th September 2013 there was a sharp positive spike in WCF (and an increased SF value). This was probably caused by an erroneous low consumption reading for a single very large DM supply point (or an incorrect overstated LDZ measurement value) in the LDZ. This resulted in a corresponding error in actual aggregate NDM consumption (total LDZ demand less LDZ shrinkage less sum of DM consumption) which was incorrectly too high giving a WCF value that was much too high.

4.0 Assessment

In the demand attribution process as currently formulated, it is principally deviations of scaling factor from the perfect value of one that cause misallocations of aggregate NDM demand to individual EUCs. Scaling factor deviations from one (offsets from one and also day to day volatility) are related to the closeness of correspondence (or otherwise) between aggregate NDM seasonal normal demand on the day and the sum for all EUCs of ALP weighted daily average demand on the day (in other words the ALP*(AQ/365) term in the NDM demand attribution formula summed across all EUCs in the LDZ). Since NDM SND has hitherto been a forecast quantity while AQ is a backward looking quantity based on historical meter read data, this correspondence could never be perfect. However, adoption of Modification 204 has resulted in this correspondence now essentially being met - except for perturbations due to small day to day changes in EUC AQs and unexpectedly high or low actual NDM demand levels (whether these are real or due to LDZ or DM measurement error). This is the main reason for the markedly improved SF behaviour since the start of gas year 2008/09.

Prior to 1st October 2008, the ratio of aggregate NDM SND to the sum across all EUCs of ALP weighted daily average demand [$\sum_{EUC} ALP*(AQ/365)$] was broadly inversely related to the deviation of SF from the ideal value of one. However, the effect was more pronounced in summer than in winter, and moreover, the summer was also affected by warm weather cut-off and summer reduction effects in some EUC models.

Warm weather cut-offs in EUC demand models give rise to summer scaling factor volatility by a mechanism involving the DAF parameter. If weather on a day in summer is significantly different from normal for that time of year, the DAF value that is applied on that day to EUCs with cut-offs may not be appropriate for the prevailing weather. Thus overall the (1 + WCF*DAF) terms in the demand attribution formula may be either too low or too high and the scaling factor has to change abnormally to compensate. This effect is not mitigated by the changes brought about by Modification 204. Thus, greater scaling factor volatility may still be seen in a number of LDZs in the summer in gas years 2011/12 and 2012/13.

In years prior to 2008/09, examination of the average monthly value of WCF-EWCF and weather corrected aggregate NDM demand as a percentage of aggregate NDM SND allowed an approximate assessment to be made of the “equilibrium level” of SF in each LDZ; that is to say the likely level of SF if any WCF deviation is discounted. This assessment was an approximate one and was based on identifying a period (of a month's duration preferably during the winter period) over which WCF deviation was small (at or near zero) and weather corrected aggregate NDM demand was close to (~100% of) aggregate NDM seasonal normal demand over the period, then identifying the average value of SF that applied to the period and adjusting this SF for any residual WCF deviation that applied in the period. When applicable to a LDZ, this assessment then provided an approximate indication of the prevailing level of aggregate NDM AQ in the LDZ.

As previously noted, with the implementation of UNC Modification 204 the difference WCF-EWCF is no longer a measure of bias in the WCF due to SND for aggregate NDM in the LDZ being under or overstated. From 1st October 2008 onwards, WCF-EWCF merely reflects the difference between actual NDM demand relative to ALP weighted daily average demand (based on EUC AQs) and computed NDM demand relative to NDM SND. In other words, the WCF itself now depends on NDM EUC AQs, and therefore assessing and removing the impact of a notional WCF "bias" on observed SF values to ascertain the impact of the prevailing level of aggregate NDM AQ on the residual SF is no longer feasible. One consequence of this is that the previously applied approach to inferring AQ excess or deficiency in each LDZ from an assessment of the impact of WCF bias on SF values, is no longer valid.

Table 15 shows the percentage changes in aggregate NDM AQs at the start of gas year 2013/14 as observed on the Gemini system. From this it can be seen that a reduction in aggregate NDM AQs has taken place for gas year 2013/14 in all LDZs except NO, WN and SO LDZs. The reduction is 0.7% overall across all LDZs and the changes range from a 0.1% increase in NO and WN LDZs to a 1.9% decrease in SC LDZ.

Figure 1

Weather Correction and Scaling Factor: SC

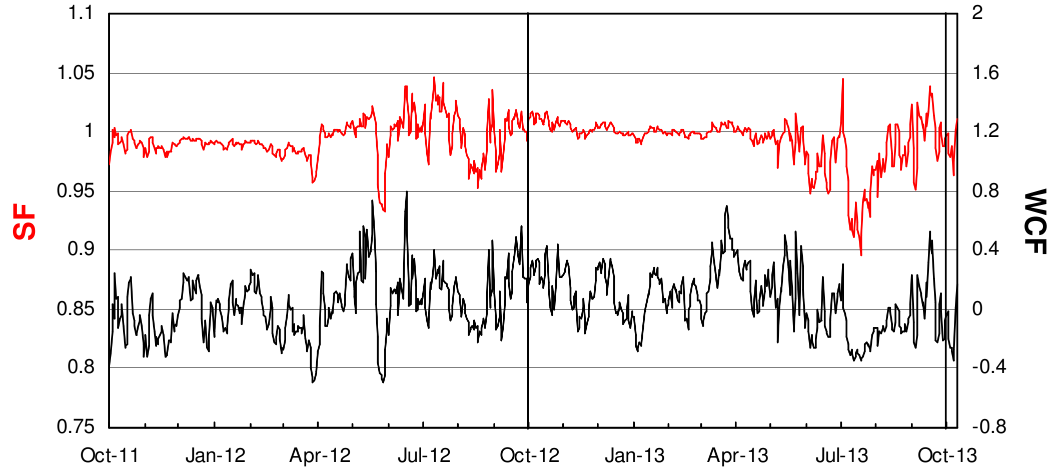


Figure 2

Weather Correction and Scaling Factor: NO

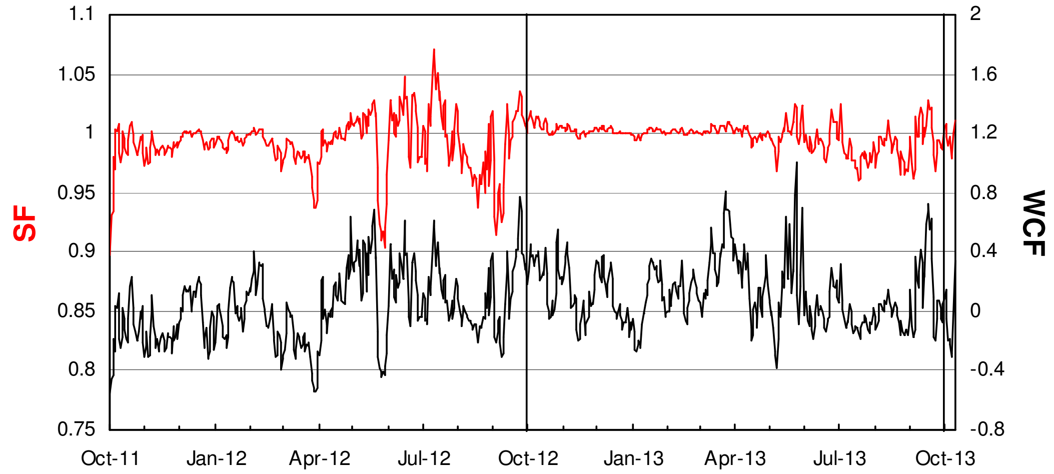


Figure 3

Weather Correction and Scaling Factor: NW

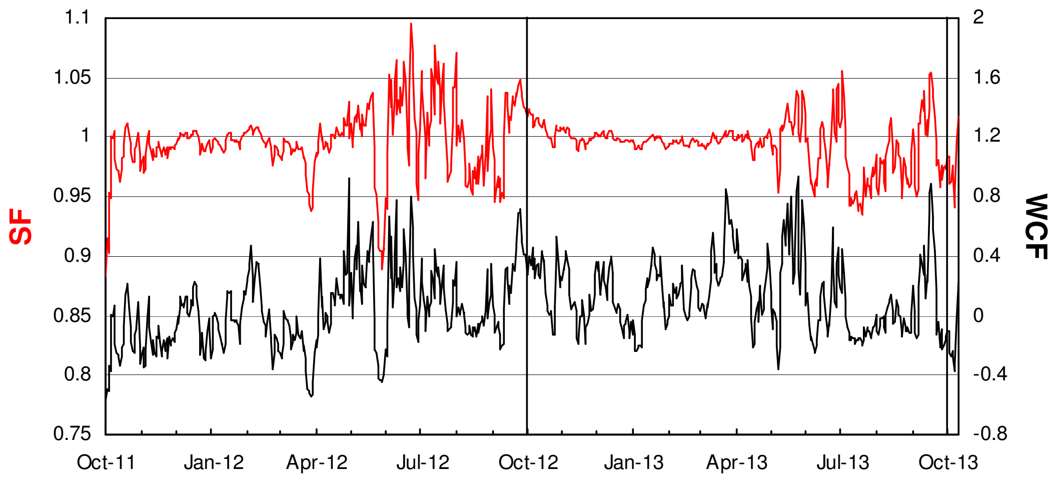


Figure 4

Weather Correction and Scaling Factor: NE

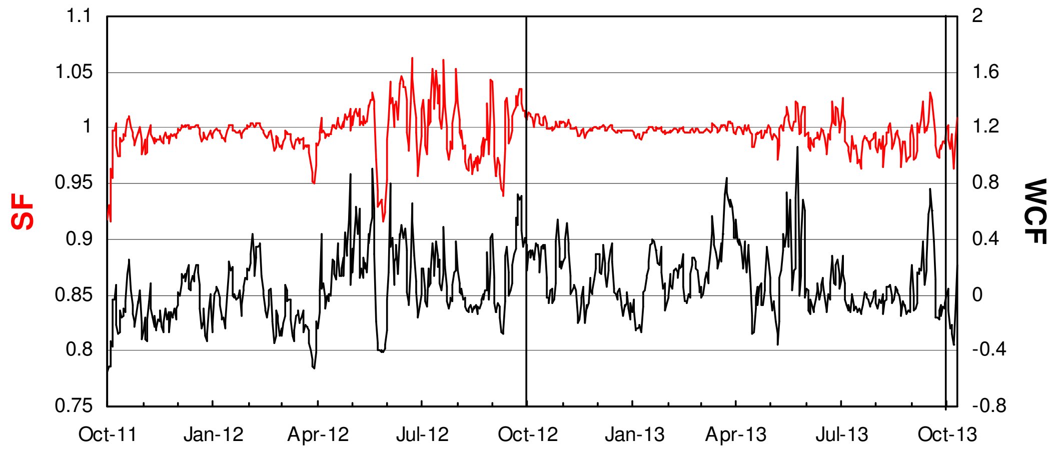


Figure 5

Weather Correction and Scaling Factor: EM

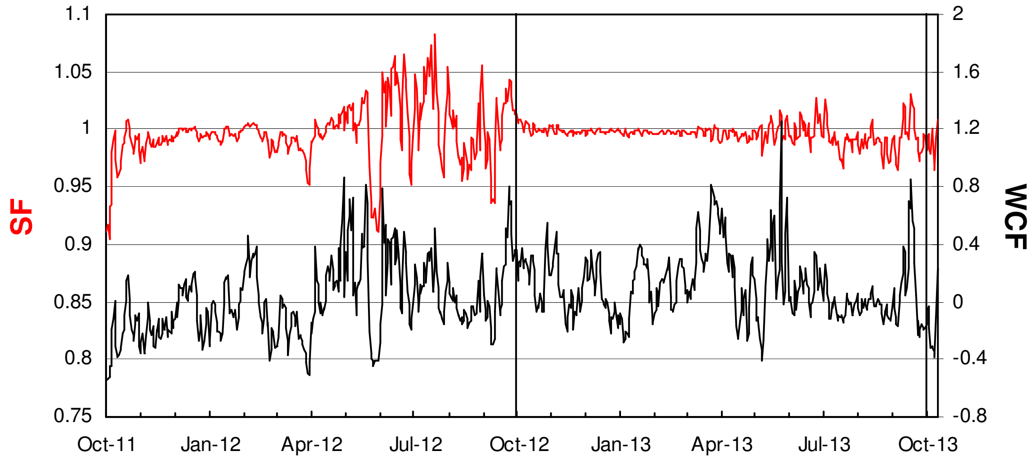


Figure 6

Weather Correction and Scaling Factor: WM

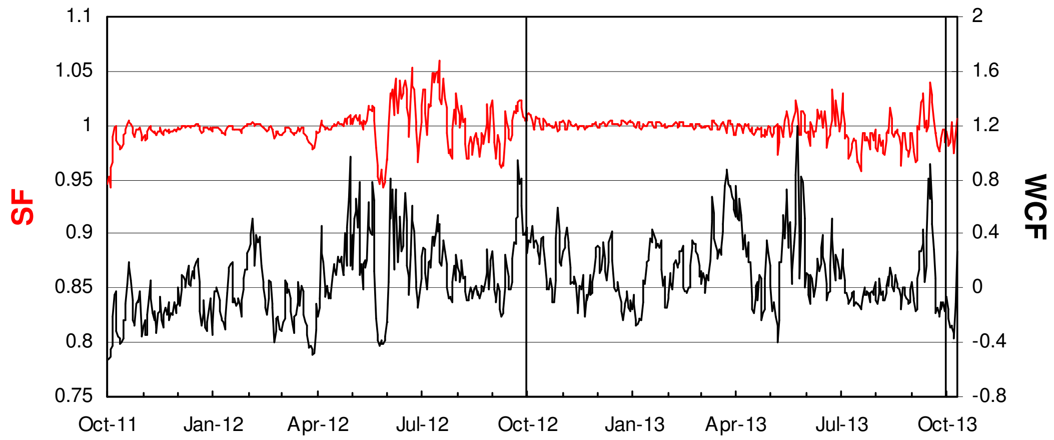


Figure 7

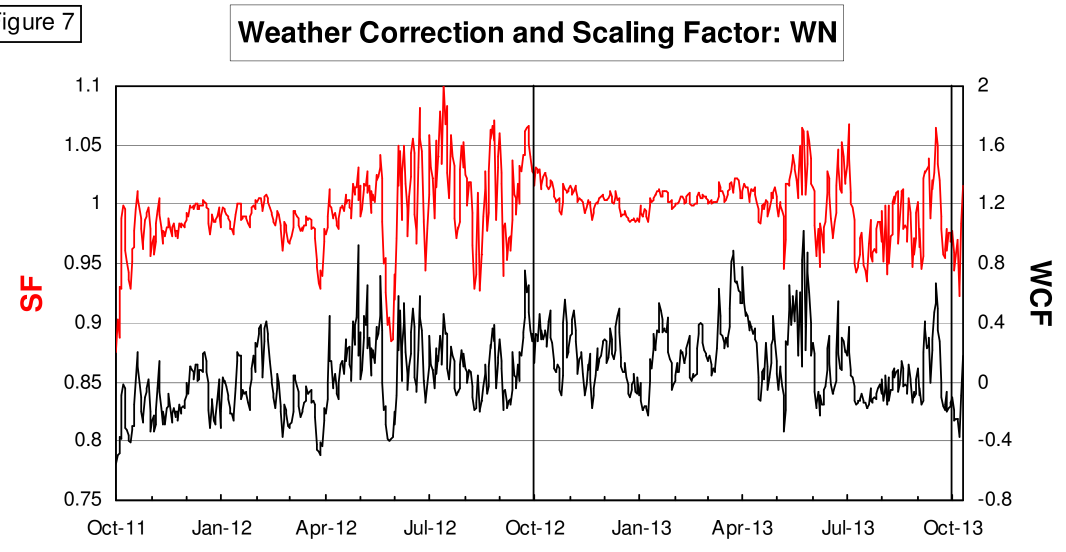


Figure 8

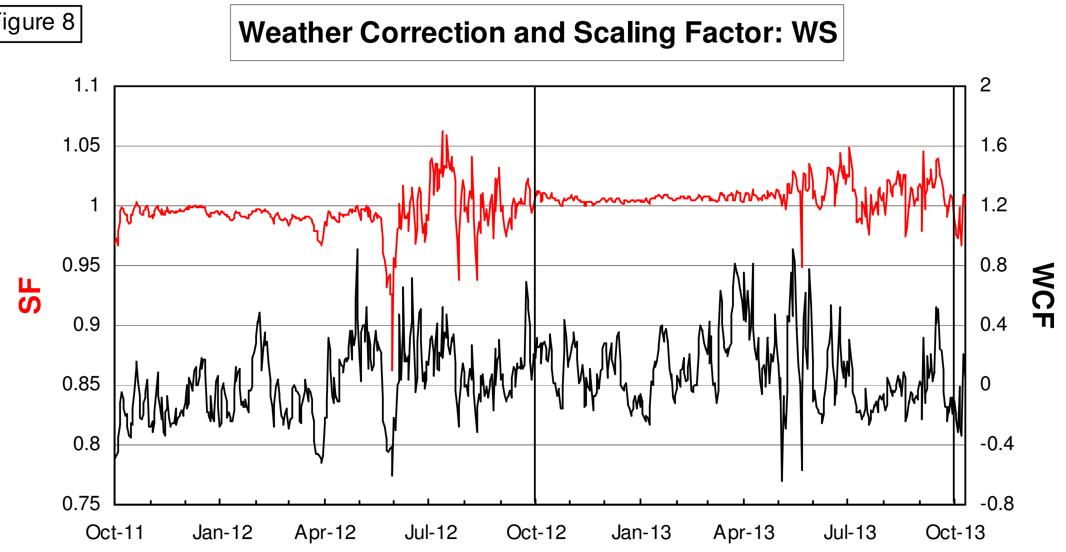


Figure 9

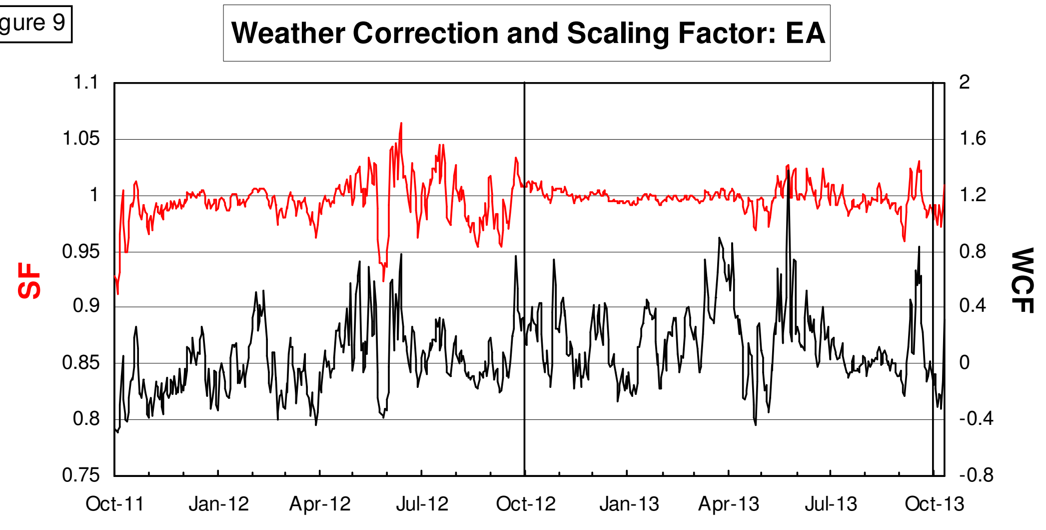


Figure 10

Weather Correction and Scaling Factor: NT

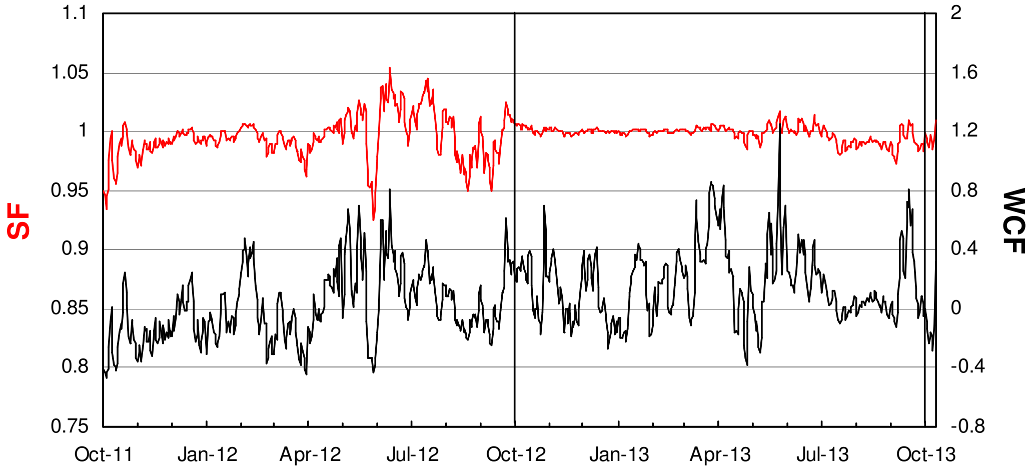


Figure 11

Weather Correction and Scaling Factor: SE

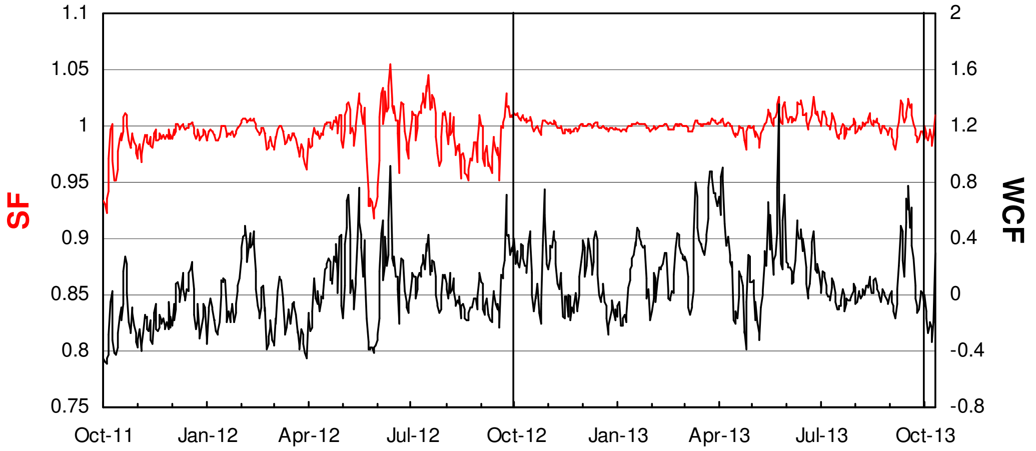
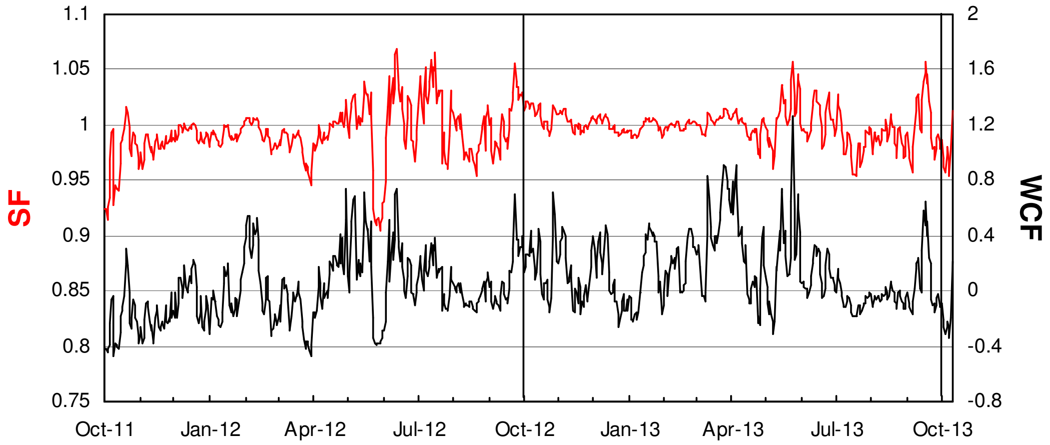


Figure 12

Weather Correction and Scaling Factor: SO



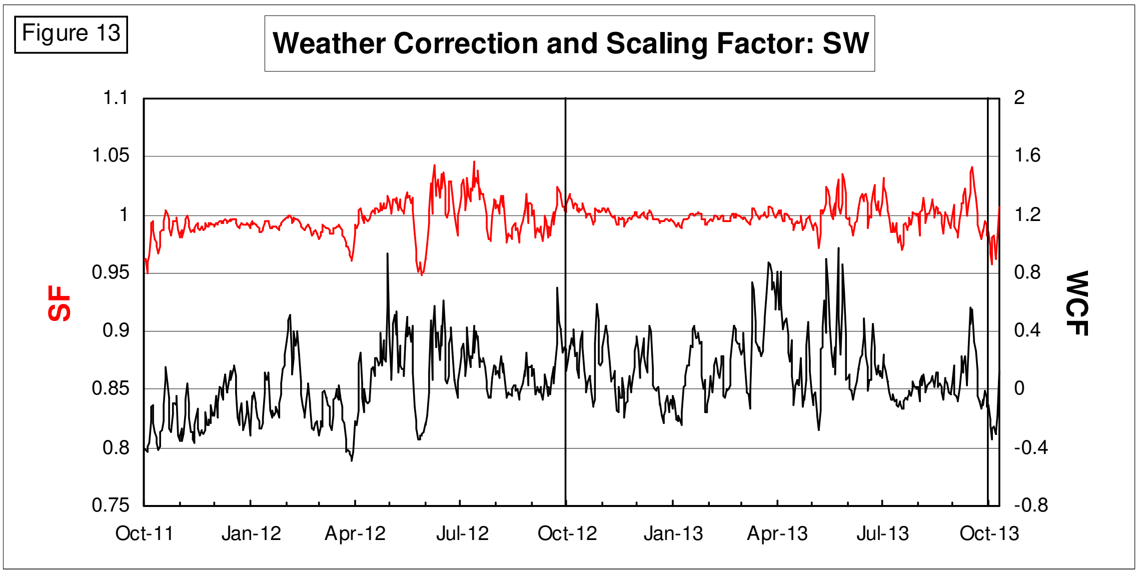


Figure 13
Weather Correction and Scaling Factor: SW
SF
WCF
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
2
1.6
1.2
0.8
0.4
0
-0.4
-0.8
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13

Table 1: Average Values of SF Gas Year 2011/12

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.994	0.993	0.993	0.994	0.988	0.999
NO	0.991	0.994	0.991	0.991	0.988	0.994
NW	0.994	1.000	0.998	1.000	0.990	1.003
NE	0.994	0.999	0.996	0.996	0.991	1.000
EM	0.996	0.999	0.996	0.998	0.989	1.004
WM	0.998	0.999	0.999	1.000	0.994	1.003
WN	0.990	0.999	0.999	1.002	0.982	1.006
WS	0.993	0.994	0.993	0.995	0.992	0.995
EA	0.993	0.994	0.995	0.996	0.989	0.998
NT	0.994	0.996	0.997	0.997	0.990	1.000
SE	0.991	0.992	0.993	0.994	0.989	0.994
SO	0.991	0.993	0.994	0.994	0.985	1.000
SW	0.995	0.995	0.997	0.997	0.988	1.002
AVG	**0.993**	**0.996**	**0.995**	**0.996**	**0.989**	**1.000**

Table 2: Average Values of SF Gas Year 2012/13

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.993	0.991	0.993	0.994	1.002	0.983
NO	0.999	0.996	0.996	0.996	1.002	0.993
NW	0.994	0.994	0.994	0.996	1.000	0.990
NE	0.997	0.996	0.995	0.996	0.999	0.994
EM	0.998	0.995	0.994	0.995	0.998	0.994
WM	0.999	0.997	0.996	0.996	1.001	0.995
WN	1.000	1.001	1.002	1.003	1.005	0.997
WS	1.009	1.007	1.008	1.009	1.006	1.011
EA	0.999	0.998	0.997	0.996	0.999	0.997
NT	0.999	0.999	0.998	0.997	1.001	0.996
SE	1.002	1.001	1.001	1.001	1.000	1.002
SO	1.000	0.999	1.001	1.000	1.002	0.998
SW	1.000	0.998	0.999	0.999	0.999	1.000
AVG	**0.999**	**0.998**	**0.998**	**0.998**	**1.001**	**0.996**

Table 3: Difference Between Average Values of SF in Gas Year 2011/12 and 2012/13

LDZ	MON-THUR	FRIDAY	SATURDAY	SUNDAY	WINTER	SUMMER
SC	-0.001	-0.002	0.000	0.000	0.010	-0.016
NO	0.008	0.002	0.005	0.005	0.010	-0.001
NW	0.000	-0.006	-0.004	-0.004	0.010	-0.007
NE	0.003	-0.003	-0.001	0.000	0.008	-0.006
EM	0.002	-0.004	-0.002	-0.003	0.009	-0.002
WM	0.001	-0.002	-0.003	-0.004	0.005	-0.002
WN	0.010	0.000	-0.001	-0.001	0.013	0.003
WS	-0.002	-0.001	-0.001	-0.004	0.002	-0.006
EA	0.006	0.004	0.002	0.000	0.010	-0.001
NT	0.005	0.003	0.001	0.000	0.009	-0.004
SE	0.007	0.007	0.006	0.005	0.011	0.004
SO	0.009	0.006	0.005	0.006	0.013	-0.002
SW	0.005	0.003	0.002	0.002	0.011	0.002

Table 4: Average Values of WCF – EWCF Gas Year 2011/12

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	-0.010	-0.004	-0.012	-0.020	-0.010	-0.012
NO	-0.019	-0.024	-0.030	-0.039	-0.019	-0.029
NW	-0.052	-0.034	-0.031	-0.023	-0.028	-0.056
NE	-0.021	-0.011	-0.011	-0.012	-0.006	-0.027
EM	-0.045	-0.044	-0.049	-0.037	-0.036	-0.053
WM	-0.028	-0.018	-0.013	0.001	-0.027	-0.013
WN	-0.064	-0.043	-0.033	-0.017	-0.042	-0.058
WS	-0.031	-0.014	-0.028	-0.027	-0.044	-0.011
EA	-0.044	-0.039	-0.028	-0.026	-0.033	-0.043
NT	-0.041	-0.029	-0.016	-0.019	-0.041	-0.023
SE	-0.063	-0.061	-0.052	-0.050	-0.049	-0.069
SO	-0.038	-0.033	-0.035	-0.035	-0.026	-0.047
SW	-0.048	-0.049	-0.029	-0.035	-0.057	-0.031
AVG	**-0.039**	**-0.031**	**-0.028**	**-0.026**	**-0.032**	**-0.036**

Table 5: Average Values of WCF – EWCF Gas Year 2012/13

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	-0.008	-0.027	-0.028	-0.022	0.015	-0.045
NO	0.067	0.058	0.036	0.035	0.053	0.061
NW	0.018	0.033	0.024	0.038	0.042	0.005
NE	0.024	0.031	0.025	0.022	0.032	0.019
EM	0.003	0.013	-0.017	-0.009	0.008	-0.008
WM	-0.002	0.011	-0.003	0.010	0.011	-0.008
WN	0.029	0.056	0.066	0.074	0.077	0.012
WS	0.017	0.007	-0.035	0.021	0.017	0.000
EA	0.033	0.049	0.049	0.037	0.039	0.037
NT	0.047	0.061	0.071	0.053	0.026	0.080
SE	0.034	0.048	0.046	0.037	0.022	0.054
SO	0.010	0.022	0.026	0.021	0.053	-0.021
SW	0.023	0.016	0.028	0.043	0.027	0.024
AVG	**0.023**	**0.029**	**0.022**	**0.028**	**0.032**	**0.016**

Table 6: Difference between average values of WCF – EWCF in Gas Year 2011/12 and 2012/13

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.003	-0.022	-0.016	-0.002	-0.004	-0.033
NO	-0.048	-0.035	-0.006	0.004	-0.033	-0.031
NW	0.035	0.001	0.007	-0.015	-0.014	0.051
NE	-0.003	-0.021	-0.014	-0.011	-0.025	0.008
EM	0.042	0.031	0.032	0.029	0.028	0.045
WM	0.026	0.007	0.010	-0.009	0.016	0.005
WN	0.035	-0.013	-0.033	-0.057	-0.035	0.046
WS	0.014	0.007	-0.007	0.006	0.027	0.010
EA	0.011	-0.010	-0.021	-0.011	-0.006	0.006
NT	-0.006	-0.032	-0.055	-0.034	0.015	-0.057
SE	0.029	0.013	0.006	0.013	0.027	0.015
SO	0.028	0.010	0.008	0.014	-0.027	0.027
SW	0.025	0.032	0.000	-0.008	0.030	0.006

Table 7: Average Values of WCF Gas Year 2011/12

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.023	0.031	0.018	0.014	-0.062	0.107
NO	0.016	0.039	0.025	0.014	-0.086	0.126
NW	-0.002	0.047	0.047	0.054	-0.093	0.133
NE	0.013	0.059	0.061	0.050	-0.083	0.146
EM	-0.011	0.019	0.022	0.026	-0.116	0.122
WM	0.013	0.043	0.061	0.063	-0.112	0.175
WN	-0.017	0.035	0.042	0.057	-0.105	0.125
WS	-0.001	0.014	0.004	0.010	-0.107	0.114
EA	-0.009	-0.003	0.017	0.034	-0.094	0.098
NT	-0.010	0.002	0.023	0.034	-0.102	0.107
SE	-0.025	-0.022	-0.004	0.014	-0.114	0.082
SO	-0.004	0.004	0.013	0.019	-0.096	0.102
SW	-0.002	0.005	0.032	0.027	-0.125	0.141
AVG	**-0.001**	**0.021**	**0.028**	**0.032**	**-0.100**	**0.121**

Table 8: Average Values of WCF Gas Year 2012/13

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.074	0.067	0.067	0.065	0.138	0.004
NO	0.126	0.125	0.101	0.097	0.161	0.075
NW	0.131	0.155	0.154	0.168	0.175	0.111
NE	0.117	0.130	0.130	0.119	0.159	0.083
EM	0.113	0.126	0.115	0.116	0.152	0.080
WM	0.134	0.140	0.148	0.150	0.167	0.111
WN	0.140	0.175	0.193	0.201	0.207	0.115
WS	0.106	0.096	0.083	0.146	0.141	0.074
EA	0.148	0.165	0.189	0.173	0.188	0.132
NT	0.158	0.174	0.205	0.184	0.171	0.170
SE	0.154	0.169	0.191	0.179	0.176	0.154
SO	0.133	0.141	0.164	0.163	0.190	0.096
SW	0.143	0.141	0.171	0.191	0.170	0.137
AVG	**0.129**	**0.139**	**0.147**	**0.150**	**0.169**	**0.103**

Table 9: Difference between absolute average values of WCF in Gas Year 2011/12 and 2012/13

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	-0.051	-0.036	-0.049	-0.052	-0.076	0.102
NO	-0.111	-0.086	-0.076	-0.083	-0.075	0.051
NW	-0.129	-0.108	-0.108	-0.114	-0.082	0.022
NE	-0.104	-0.070	-0.069	-0.069	-0.076	0.063
EM	-0.102	-0.107	-0.094	-0.090	-0.036	0.043
WM	-0.120	-0.096	-0.087	-0.087	-0.055	0.064
WN	-0.123	-0.140	-0.151	-0.144	-0.103	0.009
WS	-0.105	-0.082	-0.078	-0.136	-0.033	0.041
EA	-0.139	-0.161	-0.172	-0.139	-0.093	-0.034
NT	-0.148	-0.172	-0.182	-0.150	-0.069	-0.063
SE	-0.129	-0.147	-0.187	-0.165	-0.062	-0.071
SO	-0.129	-0.138	-0.150	-0.144	-0.094	0.007
SW	-0.140	-0.135	-0.139	-0.165	-0.044	0.004

Table 10: Root Mean Square Deviation of SF from 1 Gas Year 2011/12

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	0.0112	0.0141	0.0080	0.0105	0.0144	0.0224	0.0041	0.0291	0.0154	0.0227	0.0251	0.0150
NO	0.0284	0.0142	0.0064	0.0072	0.0120	0.0288	0.0092	0.0427	0.0227	0.0296	0.0321	0.0376
NW	0.0373	0.0138	0.0059	0.0056	0.0091	0.0264	0.0095	0.0498	0.0422	0.0398	0.0272	0.0352
NE	0.0287	0.0110	0.0048	0.0049	0.0087	0.0205	0.0074	0.0390	0.0295	0.0274	0.0267	0.0296
EM	0.0375	0.0130	0.0044	0.0057	0.0096	0.0199	0.0078	0.0444	0.0369	0.0382	0.0267	0.0306
WM	0.0213	0.0066	0.0026	0.0038	0.0047	0.0100	0.0039	0.0265	0.0285	0.0308	0.0165	0.0193
WN	0.0492	0.0224	0.0093	0.0117	0.0157	0.0312	0.0125	0.0535	0.0396	0.0469	0.0426	0.0366
WS	0.0123	0.0055	0.0044	0.0082	0.0088	0.0169	0.0089	0.0411	0.0197	0.0328	0.0207	0.0119
EA	0.0376	0.0145	0.0062	0.0066	0.0105	0.0164	0.0082	0.0356	0.0291	0.0218	0.0237	0.0227
NT	0.0296	0.0140	0.0057	0.0064	0.0092	0.0166	0.0074	0.0290	0.0270	0.0239	0.0242	0.0209
SE	0.0347	0.0138	0.0061	0.0071	0.0092	0.0174	0.0084	0.0396	0.0244	0.0207	0.0249	0.0236
SO	0.0423	0.0202	0.0092	0.0105	0.0123	0.0249	0.0106	0.0493	0.0321	0.0344	0.0213	0.0239
SW	0.0213	0.0110	0.0073	0.0093	0.0105	0.0199	0.0068	0.0257	0.0225	0.0214	0.0132	0.0128
AVG	**0.0301**	**0.0134**	**0.0062**	**0.0075**	**0.0104**	**0.0209**	**0.0080**	**0.0389**	**0.0284**	**0.0300**	**0.0250**	**0.0246**

Table 11: Root Mean Square Deviation of SF from 1 Gas Year 2012/13

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	0.0106	0.0045	0.0040	0.0044	0.0024	0.0049	0.0052	0.0129	0.0312	0.0611	0.0220	0.0216
NO	0.0083	0.0033	0.0029	0.0032	0.0019	0.0048	0.0048	0.0124	0.0115	0.0216	0.0181	0.0187
NW	0.0115	0.0053	0.0031	0.0056	0.0050	0.0045	0.0065	0.0200	0.0281	0.0442	0.0282	0.0300
NE	0.0068	0.0038	0.0025	0.0048	0.0029	0.0034	0.0062	0.0117	0.0119	0.0179	0.0175	0.0178
EM	0.0045	0.0029	0.0024	0.0037	0.0032	0.0051	0.0063	0.0090	0.0099	0.0148	0.0152	0.0178
WM	0.0051	0.0022	0.0026	0.0022	0.0016	0.0040	0.0052	0.0106	0.0116	0.0198	0.0165	0.0196
WN	0.0174	0.0077	0.0097	0.0079	0.0055	0.0118	0.0099	0.0325	0.0275	0.0401	0.0257	0.0342
WS	0.0070	0.0046	0.0041	0.0063	0.0065	0.0076	0.0085	0.0196	0.0217	0.0171	0.0164	0.0204
EA	0.0071	0.0036	0.0044	0.0050	0.0034	0.0039	0.0107	0.0138	0.0092	0.0086	0.0084	0.0186
NT	0.0035	0.0019	0.0013	0.0021	0.0011	0.0029	0.0047	0.0070	0.0055	0.0104	0.0106	0.0127
SE	0.0061	0.0035	0.0021	0.0028	0.0016	0.0031	0.0063	0.0113	0.0119	0.0066	0.0043	0.0133
SO	0.0133	0.0071	0.0060	0.0068	0.0033	0.0074	0.0111	0.0247	0.0154	0.0248	0.0149	0.0274
SW	0.0075	0.0043	0.0038	0.0057	0.0032	0.0041	0.0060	0.0155	0.0115	0.0146	0.0074	0.0170
AVG	**0.0084**	**0.0042**	**0.0038**	**0.0046**	**0.0032**	**0.0052**	**0.0070**	**0.0155**	**0.0159**	**0.0232**	**0.0158**	**0.0207**

Table 12: Difference between RMS Deviation of SF from 1 in Gas Year 2011/12 and 2012/13

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	0.0006	0.0096	0.0040	0.0061	0.0120	0.0175	-0.0011	0.0162	-0.0158	-0.0384	0.0031	-0.0066
NO	0.0201	0.0109	0.0035	0.0040	0.0101	0.0240	0.0044	0.0303	0.0112	0.0080	0.0140	0.0189
NW	0.0258	0.0085	0.0028	0.0000	0.0041	0.0219	0.0030	0.0298	0.0141	-0.0044	-0.0010	0.0052
NE	0.0219	0.0072	0.0023	0.0001	0.0058	0.0171	0.0012	0.0273	0.0176	0.0095	0.0092	0.0118
EM	0.0330	0.0101	0.0020	0.0020	0.0064	0.0148	0.0015	0.0354	0.0270	0.0234	0.0115	0.0128
WM	0.0162	0.0044	0.0000	0.0016	0.0031	0.0060	-0.0013	0.0159	0.0169	0.0110	0.0000	-0.0003
WN	0.0318	0.0147	-0.0004	0.0038	0.0102	0.0194	0.0026	0.0210	0.0121	0.0068	0.0169	0.0024
WS	0.0053	0.0009	0.0003	0.0019	0.0023	0.0093	0.0004	0.0215	-0.0020	0.0157	0.0043	-0.0085
EA	0.0305	0.0109	0.0018	0.0016	0.0071	0.0125	-0.0025	0.0218	0.0199	0.0132	0.0153	0.0041
NT	0.0261	0.0121	0.0044	0.0043	0.0081	0.0137	0.0027	0.0220	0.0215	0.0135	0.0136	0.0082
SE	0.0286	0.0103	0.0040	0.0043	0.0076	0.0143	0.0021	0.0283	0.0125	0.0141	0.0206	0.0103
SO	0.0290	0.0131	0.0032	0.0037	0.0090	0.0175	-0.0005	0.0246	0.0167	0.0096	0.0064	-0.0035
SW	0.0138	0.0067	0.0035	0.0036	0.0073	0.0158	0.0008	0.0102	0.0110	0.0068	0.0058	-0.0042
AVG	**0.0217**	**0.0092**	**0.0024**	**0.0028**	**0.0072**	**0.0157**	**0.0010**	**0.0234**	**0.0125**	**0.0068**	**0.0092**	**0.0039**

Table 13: NDM Weather Corrected Demand as % of NDM Seasonal Normal Demand Gas Year 2011/12

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	97.2%	93.9%	99.7%	99.0%	99.3%	92.9%	96.5%	105.9%	104.6%	108.2%	105.7%	100.1%
NO	96.5%	94.5%	96.0%	96.8%	99.0%	89.7%	93.5%	103.7%	104.6%	107.2%	106.3%	100.8%
NW	93.9%	90.6%	94.2%	96.5%	96.9%	89.2%	90.7%	99.8%	107.8%	109.9%	109.4%	97.7%
NE	100.0%	94.1%	98.5%	100.2%	97.7%	88.3%	96.4%	107.6%	104.9%	105.1%	106.9%	97.1%
EM	94.0%	93.3%	96.9%	97.4%	97.7%	90.8%	94.6%	105.9%	107.7%	111.9%	110.1%	96.2%
WM	92.5%	93.3%	97.1%	98.9%	98.3%	92.3%	93.5%	102.5%	110.0%	110.5%	107.4%	97.0%
WN	90.1%	90.3%	93.3%	94.7%	94.3%	92.2%	93.4%	102.2%	104.8%	116.9%	121.3%	95.8%
WS	91.7%	91.2%	95.9%	95.0%	95.6%	87.2%	94.7%	96.0%	103.9%	112.0%	108.5%	95.1%
EA	88.4%	89.9%	94.3%	95.9%	95.9%	93.8%	91.9%	105.7%	106.9%	103.0%	102.6%	91.9%
NT	89.2%	91.6%	94.3%	95.5%	97.0%	92.4%	91.6%	104.3%	114.4%	110.0%	100.0%	88.7%
SE	89.7%	90.4%	93.5%	94.5%	96.5%	92.1%	90.0%	101.3%	102.3%	105.0%	102.8%	89.6%
SO	91.9%	91.4%	95.9%	98.2%	98.6%	93.6%	93.7%	106.4%	108.0%	112.1%	109.7%	97.3%
SW	89.5%	89.3%	94.1%	93.8%	96.3%	90.2%	92.4%	102.0%	108.1%	113.1%	111.5%	91.8%

Table 14: NDM Weather Corrected Demand as % of NDM Seasonal Normal Demand Gas Year 2012/13

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	97.9%	98.4%	96.8%	96.1%	96.6%	100.0%	98.8%	102.7%	97.4%	99.2%	96.9%	99.2%
NO	96.5%	99.8%	97.3%	98.5%	100.2%	105.7%	103.8%	106.9%	102.0%	110.3%	105.6%	101.4%
NW	96.2%	94.7%	94.1%	95.0%	95.5%	96.7%	97.6%	97.2%	96.7%	109.2%	102.4%	96.5%
NE	97.3%	95.8%	94.4%	97.8%	97.1%	99.4%	97.6%	99.0%	97.0%	109.8%	101.8%	96.0%
EM	92.6%	95.4%	94.8%	94.5%	95.3%	96.1%	95.7%	93.2%	93.7%	102.0%	99.9%	91.6%
WM	94.4%	95.1%	94.6%	95.1%	96.4%	98.7%	97.6%	93.3%	97.3%	105.6%	95.7%	92.5%
WN	95.0%	96.4%	94.5%	97.0%	97.5%	98.2%	100.2%	99.0%	100.5%	113.3%	107.6%	92.9%
WS	93.0%	94.2%	93.9%	94.0%	95.7%	100.1%	103.1%	88.0%	94.3%	103.1%	98.7%	99.0%
EA	94.4%	95.0%	96.5%	96.2%	98.3%	102.4%	95.4%	94.3%	106.8%	106.2%	101.5%	95.5%
NT	93.2%	93.5%	96.1%	95.7%	97.6%	101.5%	99.2%	95.3%	111.0%	103.3%	100.7%	102.9%
SE	90.9%	92.6%	95.3%	94.7%	97.1%	99.9%	99.9%	94.1%	108.9%	105.2%	104.3%	98.7%
SO	98.1%	97.7%	97.8%	97.6%	99.5%	105.4%	97.9%	94.1%	104.7%	101.3%	105.0%	105.2%
SW	90.6%	93.8%	95.8%	94.7%	96.5%	102.1%	101.8%	92.8%	103.2%	103.8%	107.8%	102.4%

Table 15: Aggregate NDM AQs at Start of Gas Year 2013/14

Based on data extracted from the Gemini system for gas days 29/09/13 and 08/10/2013

LDZ	% NDM AQ Change
SC	-1.9%
NO	0.1%
NW	-0.7%
NE	-1.3%
EM	-0.7%
WM	-1.1%
WN	0.1%
WS	-0.4%
EA	-0.5%
NT	-0.5%
SE	-0.8%
SO	0.03%
SW	-0.2%
Overall	-0.7%