EVALUATION OF ALGORITHM PERFORMANCE – 2010/11 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 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, 2009/10 and 2010/11, 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 2009/10 and 2010/11. This is a change from practice prior to 2010 which showed SF and WCF-EWCF. Additionally, the scale used to display SF has been greatly increased in these figures in response to feedback received. Note that SF behaviour has not degraded compared to previous years; the change of scale is the reason why these SF patterns look very different to equivalent figures in assessments prior to 2010. Tables of average values of SF, WCF-EWCF and WCF, for gas years 2009/10 and 2010/11, along with the improvement or degradation in these averages between the two gas years, are presented in Tables 1 to 9. It should also be noted that SF and WCF values have been obtained for the period 1st to 10th October 2011 (the start of the new gas year 2010/11) and appended to the graphs of the previous two completed gas years. The root mean square deviation of SF from 1 has also been computed for each discrete month during the previous gas years 2009/10 and 2010/11, 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 2009/10 and 2010/11 respectively.

2.0 Overall Results

These various graphs and tables indicate the following notable points:

- During gas years 2009/10 and 2010/11 average SF values were lower than one (over days of the week, weekends, winter and summer) except for NT in 2009/10.
- For 10 out of 13 LDZs on weekdays and Sundays, and 9 out of 13 LDZs on Fridays and Saturdays, average values of SF were improved in 2010/11 (i.e. were closer to one) compared to the previous gas year (2009/10). NO, EA and NT LDZs showed deterioration from the previous gas year on all days of the week, SW was the same on Saturdays, and WM showed deterioration on Fridays.
- Average SF values for all of winter 2010/11 showed an improvement over winter 2009/10 in 7 LDZs (namely SC, NW, NE, EM, WN, SE and SO LDZs), were the same in 2 LDZs relative to winter 2009/10 (namely WS and SW LDZs) and showed a small deterioration (of 0.001) in 4 LDZs (namely NO, WM, EA and NT LDZs).
- Over the summer period of 2010/11 for 10 out of the 13 LDZs (namely SC, NW, NE, EM, WM, WN, WS, SE, SO and SW) average values of SF were closer to the ideal value of one than over the summer period of the previous gas year (2009/10) and further away from one in 3 LDZs (namely NO, EA and NT).
- The RMS deviation of SF from the ideal value of one provides a measure of the variability of SFs. During winter 2010/11, October 2010 was slightly colder than the current seasonal normal basis. November 2010 was also colder than seasonal normal (the 9th coldest in the last 50 years). December 2010 was very cold (the coldest December in over 100 years), January 2011 was colder than seasonal normal, February 2011 was warmer than seasonal normal (the 4th warmest in the last 50 years) and March 2011 was warmer than seasonal normal (the 11th warmest March in the last 50 years). For October and November RMS deviations improved over the previous gas year (2009/10) in 7 and 7 LDZs respectively and overall across all LDZs in October compared to the corresponding months of the previous gas year. During the months of December to February, the majority of individual LDZs and all LDZs considered overall showed worse RMS deviations compared to the corresponding periods of the previous gas year. In the warm month of March 2011, RMS deviation was worse in all LDZs and in all LDZs considered overall.
- RMS deviations of SF from the ideal value of one exhibited a mixed picture during the summer period (April to September) of gas year 2010/11. In each summer month, 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 was better in May, June and July and worse in April, August and September than in gas year 2009/10. April 2011 was very warm (the warmest April in over 100 years) and May 2011 was also warmer than seasonal normal, June, July and August 2011 were cooler than seasonal normal and September 2011 was warmer than seasonal normal with a notable warm period at the end of the month.
- Considered overall SFs during 2010/11 generally were slightly more 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 nearly all individual LDZs, compared to that over the equivalent days of the previous gas year. Exceptions were NO and WN on weekdays. For winter 2010/11 as a whole the deviation of WCF from EWCF was less marked over that for winter 2009/10 in all LDZs apart from 5 LDZs (NW, NE, EM, WN and EA). For summer 2010/11 as a whole the deviation of WCF from EWCF was less marked over that for summer 2009/10 in all LDZs apart from 6 LDZs (NO, NW, WN, EA, NT and SE). 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 2009/10 average WCF values were negative for all LDZs on all days of the week, for all LDZs during the summer period and for 6 LDZs in winter 2009/10 (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 2010/11 average WCF values were positive for all LDZs on all days of the week (except for 7 LDZs on Fridays and 2 LDZs on Saturdays) and for all LDZs during the winter period, but were negative for all LDZs in the summer period (See Table 8). Positive values can be caused by factors such as the EUC AQs being too low or by the weather being colder than seasonal normal.
- WCF was closer to zero in 2010/11 than in 2009/10 on weekdays and Fridays in all LDZs, on Saturdays in 12 LDZs and on Sundays in 6 LDZs (see Table 9). In summer 2010/11 WCF was closer to zero in 11 out of 13 LDZs, but was further away from zero in winter 2010/11 in all LDZs. The differences between the years are the result of differences in factors such as weather or EUC AQ excess.
- Comparison of weather corrected aggregate NDM demand as a percentage of aggregate NDM SND in 2009/10 (Table 13) and 2010/11 (Table 14) indicates that for a majority of the month/LDZ combinations these percentages for 2010/11 are lower than those for 2009/10. This suggests that *relative to observed demand on a weather corrected basis,* the SND values that applied (for computing DAFs for example) in 2010/11 were generally higher than in 2009/10.

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 (2010/11). In part, these instances (up to May 2011) have previously been reported in Appendix 13 of the NDM report published on 27th June 2011. They are all included here for completeness. 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:

- The month of October 2010 was slightly colder than the current seasonal normal basis overall. However there were some warm days around the 8th to 10th October which resulted in depressed aggregate NDM demands in all LDZs and reduced WCFs on these days in every 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 all 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 the 24th to 26th), the WCF was strongly positive with a corresponding small increase in SF values on these days.
- Overall November 2010 was the 9th coldest November in the last 50 years (and the coldest since 1993), but there were some warm days at the start of the month. The weather in the period from the 2nd to the 5th was mild and the 4th was one of the warmest ever November days. During this period, aggregate NDM demand was reduced in most LDZs resulting in sharply negative WCF values (and corresponding small decreases in SF). During the last 7 days of the month (24th to 30th) the weather was particularly cold with the 30th being the coldest November day in the gas industry records. In this 7 day period, inflated aggregate NDM demand in all LDZs resulted in sharply positive WCF values. While an increased 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.

  In WS LDZ on 9th November 2010 there was a sharp positive spike in the WCF (and an increased SF value). This was probably caused by an erroneous low consumption reading for a single very large DM supply point 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 in turn a WCF value that was much too high.

- December 2010 was much colder than the current seasonal normal basis for most of the month, only reaching seasonal normal levels on the last 3 days. According to the Met. Office it was the coldest December in over 100 years and the coldest calendar month since February 1986. The periods from the 1st to the 8th and the 16th to 26th were particularly cold, with snowfall occurring quite widely across the country. During these periods, 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 very small increase in the SF in most LDZs (except WS and SW). In the last few days of the month as the weather returned to seasonal normal, WCF reduced and was around zero by the 31st in all LDZs.
- Overall January 2011 was slightly colder than the current seasonal normal basis and around the average for the last 50 years. The month started slightly colder than normal and then became mild and wet for the period between the 12th and 17th which resulted in depressed aggregate NDM demands in all LDZs and reduced WCFs in this period in every 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 all LDZs this direct effect was predominant leading to corresponding but smaller decreases in SF on these days. The second part of January was generally colder than normal particularly around the 20th to 22nd and 26th to 31st, resulting in inflated aggregate NDM demands and positive WCF values (with SF values increasing to around one) in most LDZs.
- Nationally, February 2011 was warmer than the current seasonal normal basis. It was the 4th warmest February in the last 50 years and the mildest since 2002. It was particularly warm in the periods from the 4th to 6th, 9th to 12th and 24th to 26th. During these periods aggregate NDM demand was depressed, resulting in negative WCF values. While the reduction in WCF would have tended to increase the SF, the direct effect on the SF of the reduced aggregate NDM demand resulted in small decreases in the SF on these days in most LDZs.
- Taken as a whole, the month of March 2011 was just above the current seasonal normal basis, starting below and finishing above seasonal normal. It was the 11th warmest March in the last 50 years. In nearly all LDZs the warmest periods of the month were 22nd to 25th and 29th to 31st and the coldest period was the 1st to 7th. SC LDZ also had a cold spell (including snow) on the 11th to 14th. During the warm days, aggregate NDM demand was sharply depressed leading to negative WCF values in most LDZs. The lower WCF would have tended to inflate the SF. However, the direct effect of depressed aggregate NDM demand on SF would have tended to depress the SF and it was this direct effect that prevailed in many LDZs, particularly the more northerly LDZs. On the cold days, aggregate NDM demand was increased and consequently there was a positive spike in WCF in all LDZs, particularly in SC LDZ on the 12th. The increased WCF would have tended to deflate the SF, but again the direct effect on the SF of inflated aggregate NDM demand resulted in a corresponding small increase in SF.
- Nationally, the month of April 2011 was the warmest April in the gas industry weather history. According to the Met. Office, it was the warmest April in over 100 years and the warmest April in Central England in over 350 years. Throughout the month it was consistently warmer than the current seasonal normal basis. As a result, aggregate NDM demand was depressed and WCF was negative in all LDZs on nearly all days in the month. The 6th to 11th and 19th to 25th were unseasonably warm and sharply negative WCF values may be observed during these periods in most LDZs. During the second notable warm spell (19th to 25th), aggregate NDM demand fell to between 35% and 60% of the ALP weighted daily average demand in most LDZs (except SC and NO). This sharp reduction in aggregate NDM demand resulted in correspondingly extreme negative spikes in WCF in these LDZs. Although the reduced value of WCF acts to increase SF, the direct effect of the reduced aggregate NDM demand predominated, leading to sharp reductions in SF in these LDZs.
- The month of May 2011 was just above the current seasonal normal basis overall, with a notable period of warm weather that occurred in all LDZs from approximately 6th May to 12th May. As a result, aggregate NDM demand was depressed during this period. This reduction in aggregate NDM demand resulted in correspondingly negative values in WCF and reduced values of SF in most LDZs. The lower WCF would have tended to inflate the SF. However, the direct effect of depressed aggregate NDM demand on SF would have tended to depress the SF and it was this direct effect that prevailed. There were also a few cool days in the month, most notably during the period from 26th to 28th and on Bank Holiday Monday (30th) in most LDZs (outside of the south east of the country) and on the 25th in SC LDZ. During these cool days, WCF values were positive in the affected LDZs and SF values also showed a small positive spike.

- Despite a warm start and end to the month, nationally the month of June 2011 was cooler than the current seasonal normal basis (the coolest June since 2001) with the coolest period occurring between the 10th and 12th (which experienced unusually low overnight temperatures). On these cooler days, aggregate NDM demand was increased and consequently WCF values were sharply positive in most LDZs, particularly on the 12th. The increased WCF would have tended to deflate the SF, but the direct effect on the SF of inflated aggregate NDM demand resulted in a corresponding increase in SF. On the warmest days (2nd to 4th and 26th to 28th), most LDZs show displayed negative WCF values. A corresponding decrease in SF in most LDZs is also evident over these warmest days of the month, particularly on the 3rd and 27th. While a reduced WCF due to depressed aggregate NDM demand 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.
- Nationally, the month of July 2011 was also cooler than the current seasonal normal basis with the coolest weather occurring between the 17th and 24th. All LDZs except SC show positive WCF values during this period. A corresponding increase in SF is also evident in most LDZs (most clearly seen in NW LDZ). While an increased WCF would act on SF to decrease its value, the direct effect of increased aggregate NDM demand on SF is to increase its value and this appears to have been the stronger effect during this period. There were also some warm days in the month (e.g. 3rd to 5th) when WCF values were negative and SF values were depressed in most LDZs (particularly in LDZs: SC, NO, NW, NE, EM, WM and WN).

  In NE LDZ on 11th July 2011 there was a sharp negative spike in the WCF (and a much reduced SF value). This was probably caused by an erroneous high consumption reading for a single DM supply point 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 low giving in turn a WCF value that was much too low.
- Despite a warm start, August 2011 was colder than the current seasonal normal basis (similar to August 2010, which was the coolest August since 1993). The coolest weather occurred from the 7th to 10th, 17th to 19th and 26th to 31st. Most LDZs showed an increase in WCFs during these days and sharply positive spikes in WCF are evident on the coldest days (particularly on the 28th in SC and 29th in LDZs: SC, NO, NW, NE, EM, WM and WN). SF values also increased above one in most LDZs during the coolest days (most clearly seen in LDZs: SC, NW and EM). 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 increased SF values on these days. In contrast on the warm days at the start of the month (1st to 5th), WCF values were negative and SF values were depressed in most LDZs.

  In EM LDZ on 12th August 2011 there was a positive spike in the WCF (and an inflated SF value). This was probably caused by an erroneous low consumption reading for a single very large DM supply point 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 in turn a WCF value that was too high.
- Nationally, the month of September 2011 was just above the current year seasonal normal basis overall. It was the 4th warmest September in the last 50 years with a notable warm period occurring at the end of the month (from the 27th onwards). On the warmest days (29th and 30th) aggregate NDM demand fell to between 42% and 62% of the ALP weighted daily average demand in all LDZs. This sharp reduction in aggregate NDM demand resulted in correspondingly extreme negative spikes in WCF in these LDZs. Although the reduced value of WCF acts to increase SF, the direct effect of the reduced aggregate NDM demand predominated, leading to sharp reductions in SF on these warm days in all LDZs.

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 causes 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 2009/10 and 2010/11.

Hitherto, EUC demand models with summer reductions also gave rise to summer scaling factor volatility. Here, the mechanism involved the ALP parameter. If weather on a day in summer was significantly different from normal for that time of year, the ALP value that was applied on that day to EUCs with summer reductions may not have been appropriate for the prevailing weather. Thus, overall the ALP*(AQ/365) terms in the demand attribution formula may have been too low or too high and the scaling factor changed abnormally to compensate. However, with the change to WCF resulting from Modification 204, errors in the ALP*(AQ/365) terms should be (at least partly) compensated for in the revised definition of WCF. Thus, this effect is now expected to not contribute as significantly to summer scaling factor volatility.

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 2011/12 as observed on the Gemini system. From this it can be seen that a small reduction in aggregate NDM AQs has taken place for gas year 2011/12 in all LDZs except EM LDZ. The reduction is 1.0% overall across all LDZs and the changes range from a 0.2% increase in EM LDZ to 2.6% reduction in NO LDZ.

Figure 1

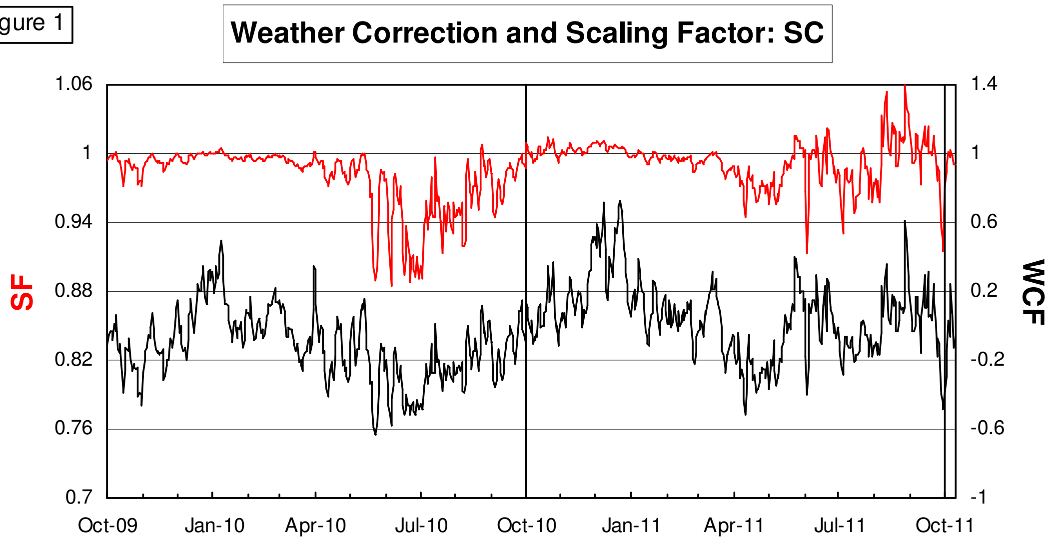


Figure 2

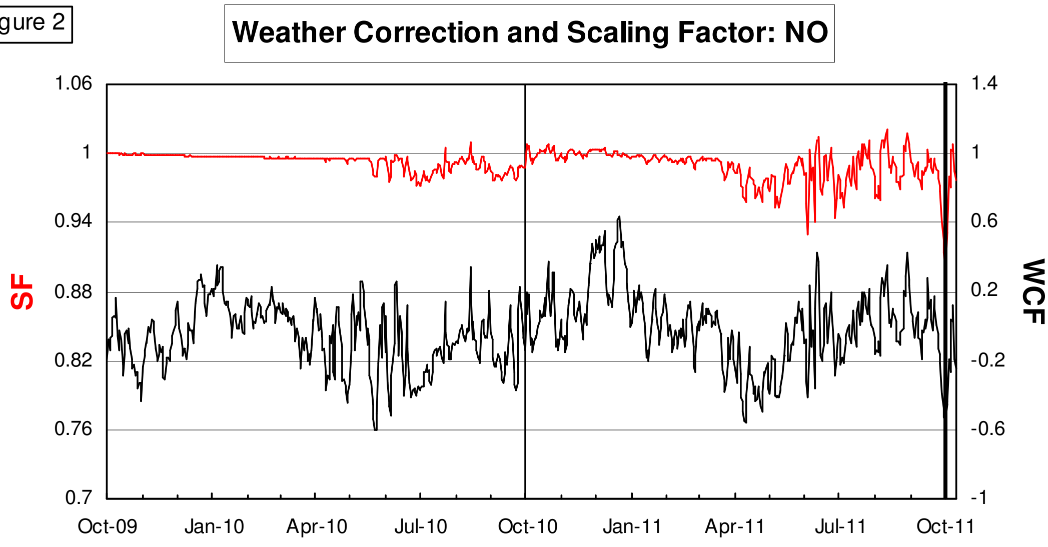
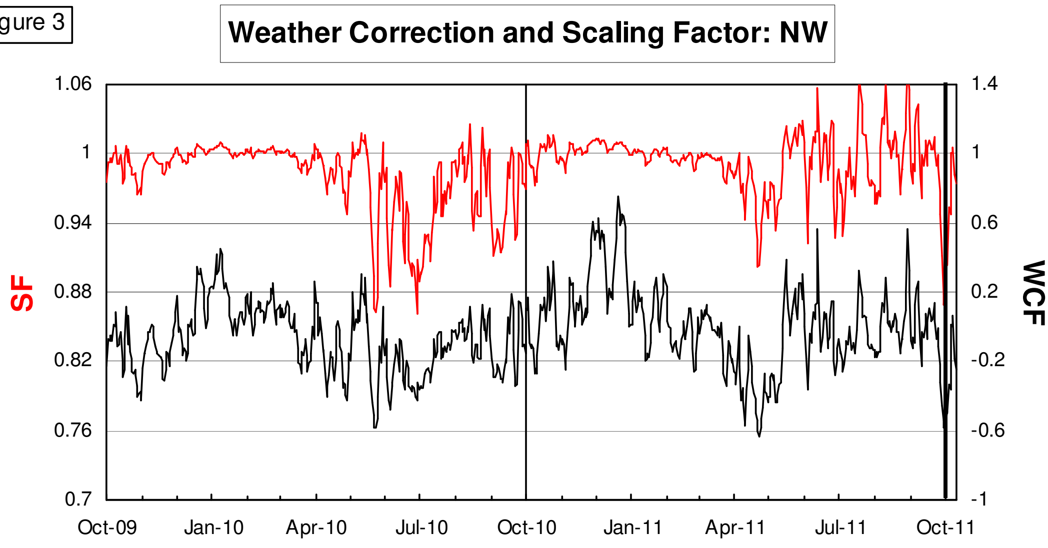


Figure 3



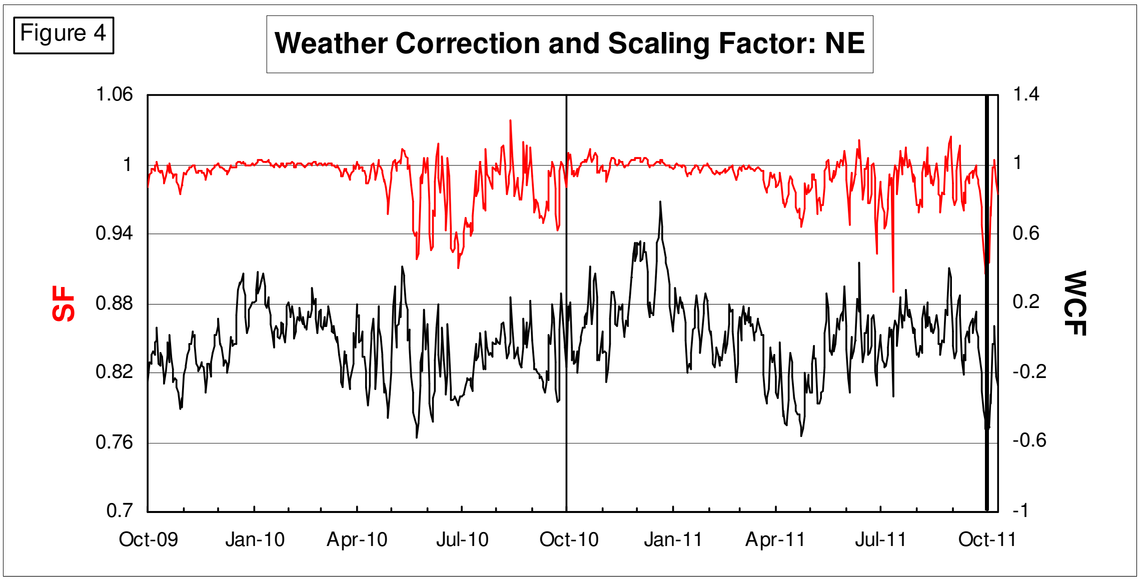


Figure 4
Weather Correction and Scaling Factor: NE
1.06
1
0.94
0.88
0.82
0.76
0.7
SF
1.4
1
0.6
0.2
-0.2
-0.6
-1
WCF
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11

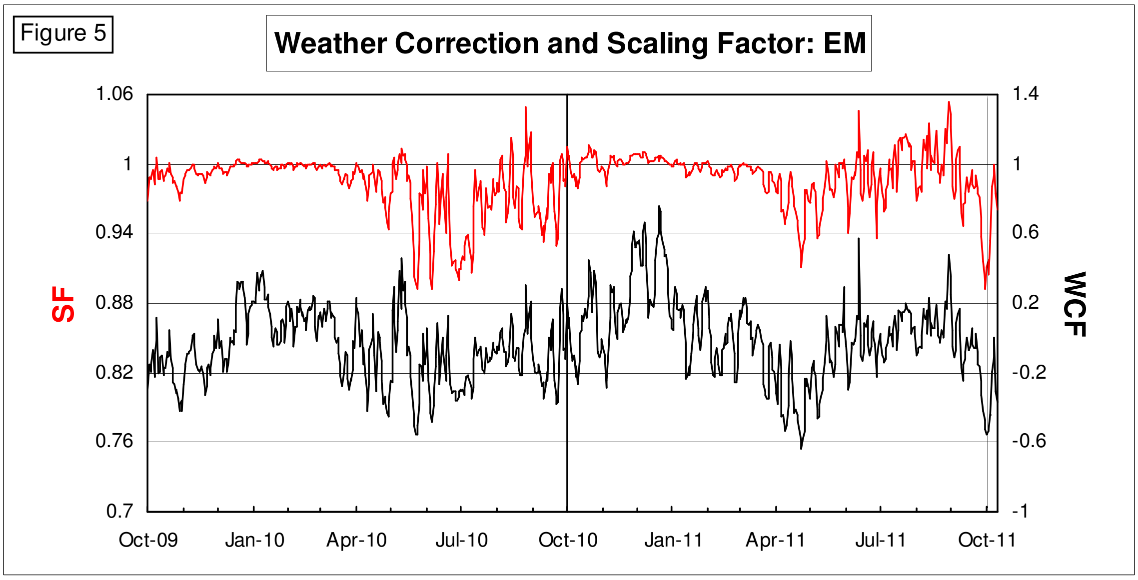


Figure 5
Weather Correction and Scaling Factor: EM
1.06
1
0.94
0.88
0.82
0.76
0.7
SF
1.4
1
0.6
0.2
-0.2
-0.6
-1
WCF
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11

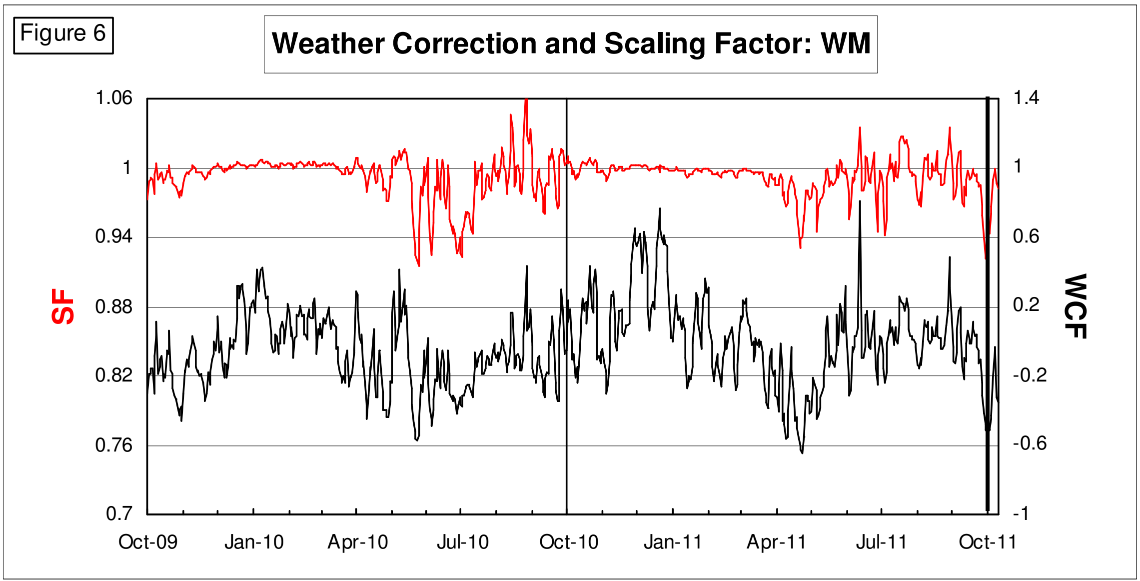


Figure 6
Weather Correction and Scaling Factor: WM
1.06
1
0.94
0.88
0.82
0.76
0.7
SF
1.4
1
0.6
0.2
-0.2
-0.6
-1
WCF
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11

Figure 7

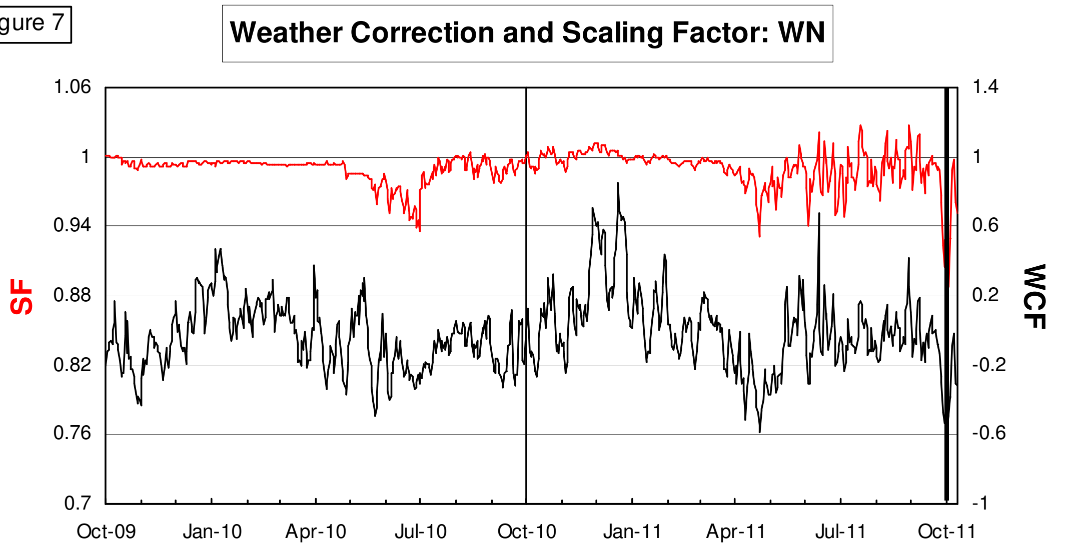


Figure 8

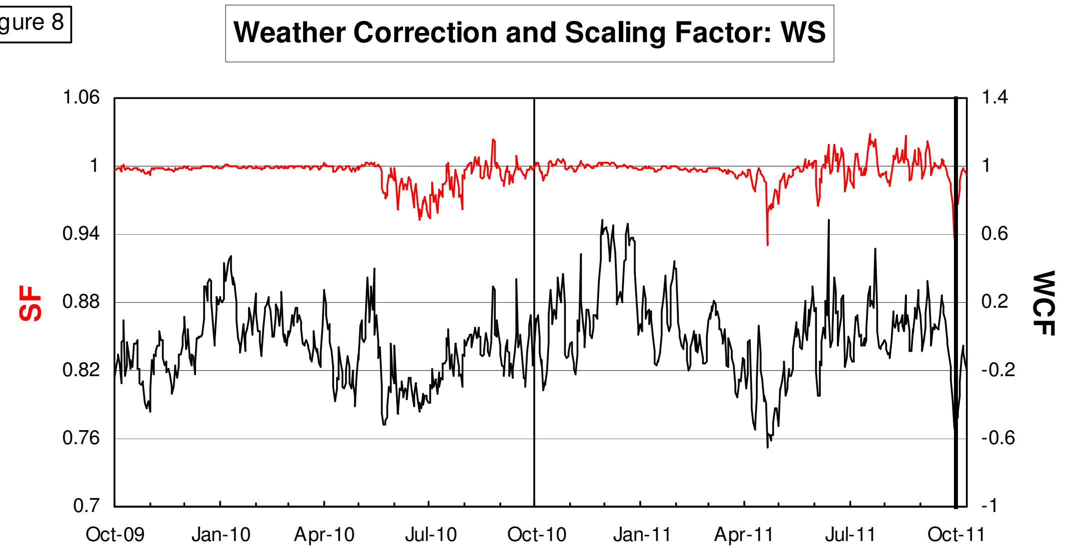


Figure 9

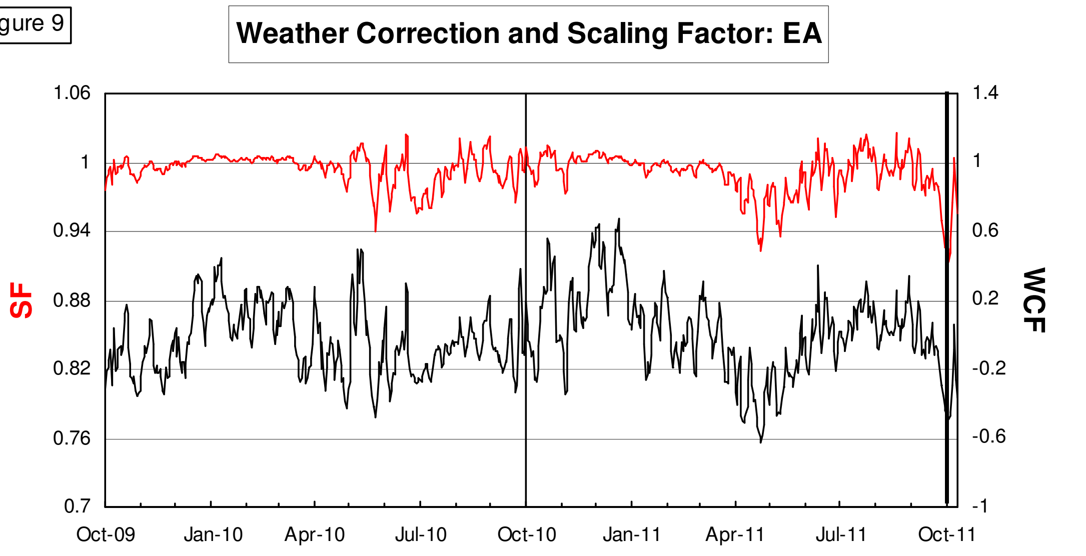


Figure 10

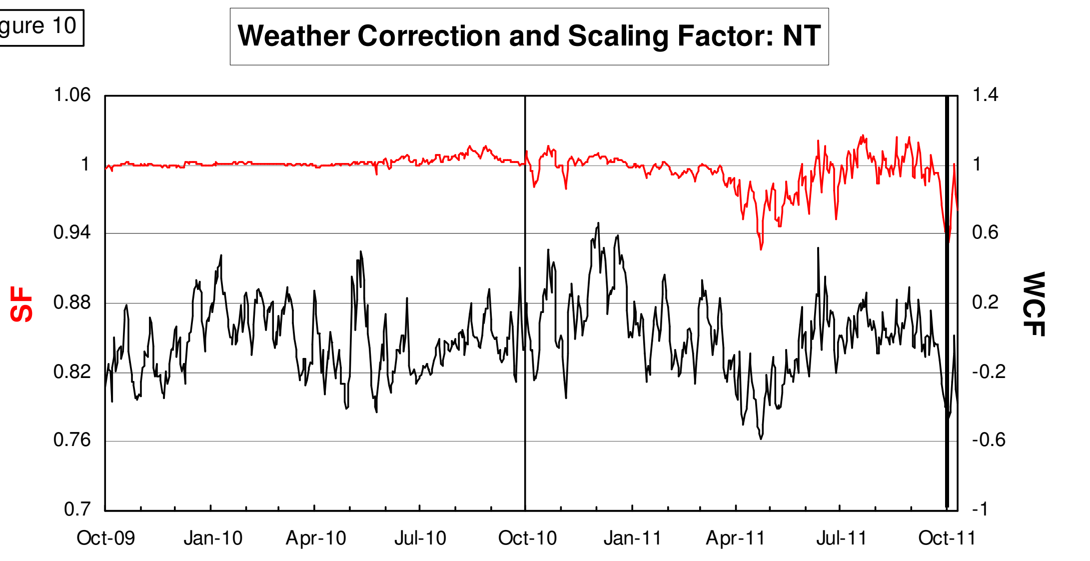


Figure 11

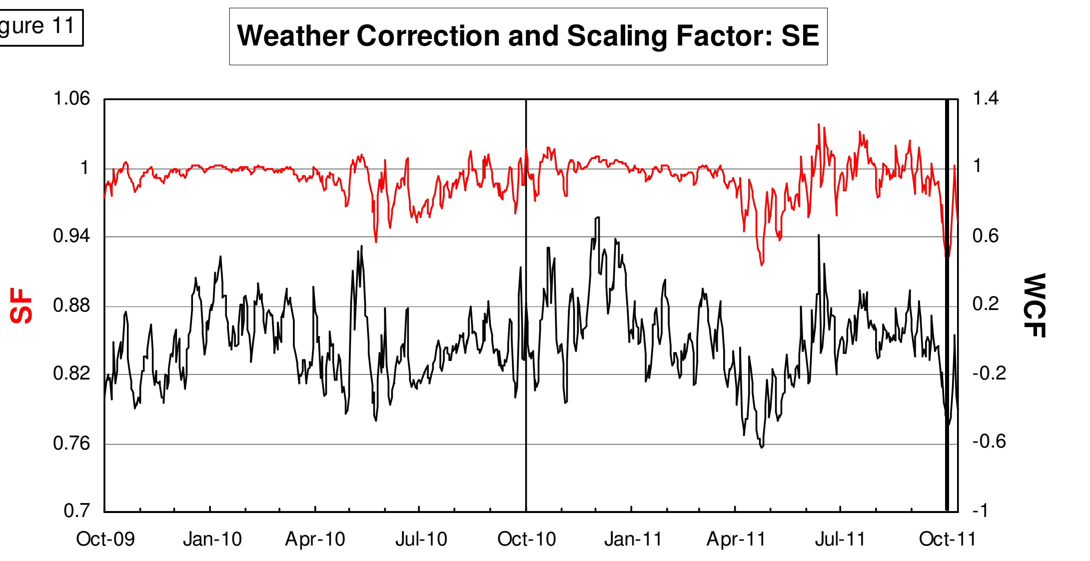
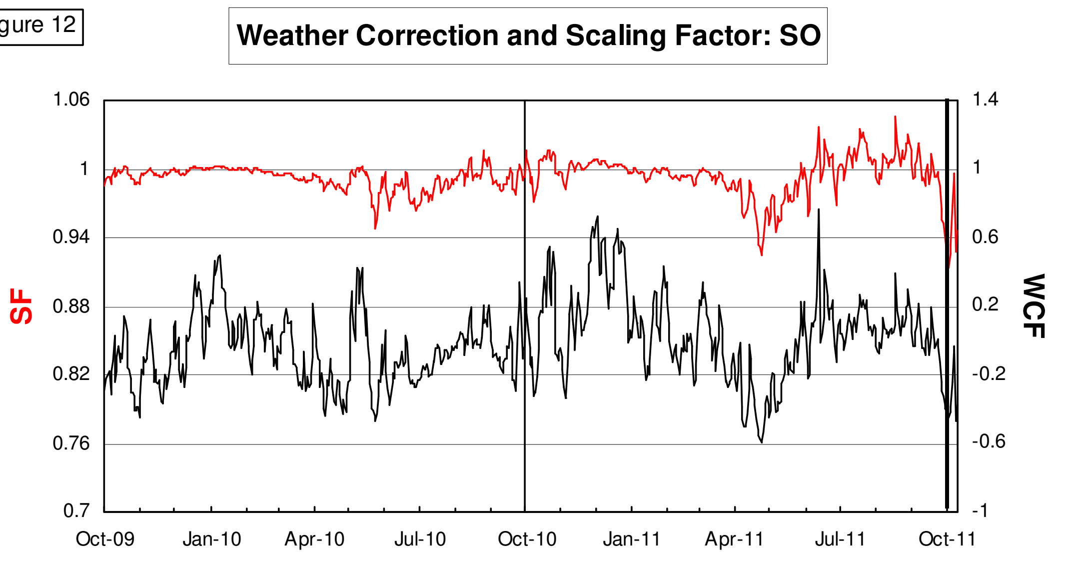


Figure 12



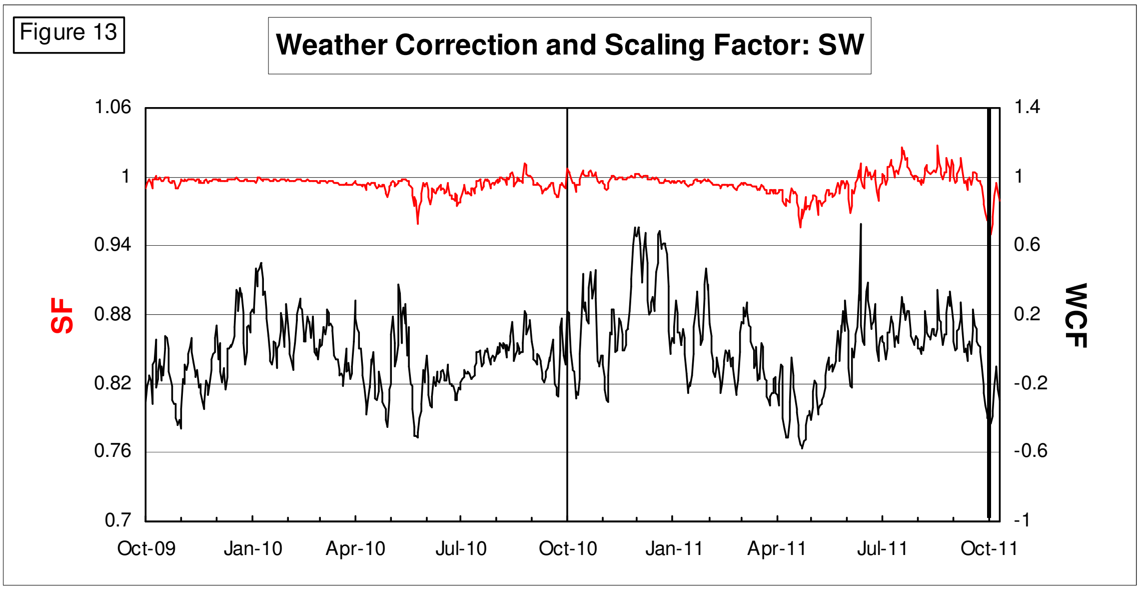


Figure 13
Weather Correction and Scaling Factor: SW
SF
WCF
1.06
1
0.94
0.88
0.82
0.76
0.7
1.4
1
0.6
0.2
-0.2
-0.6
-1
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11

Table 1: Average Values of SF Gas Year 2009/10

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.978	0.974	0.974	0.976	0.995	0.962
NO	0.993	0.993	0.994	0.994	0.998	0.989
NW	0.978	0.976	0.976	0.980	0.997	0.962
NE	0.986	0.987	0.988	0.989	0.997	0.980
EM	0.980	0.979	0.978	0.980	0.995	0.968
WM	0.992	0.992	0.989	0.991	0.999	0.987
WN	0.988	0.988	0.991	0.991	0.995	0.984
WS	0.994	0.995	0.994	0.995	0.999	0.991
EA	0.994	0.994	0.994	0.995	0.999	0.991
NT	1.002	1.002	1.002	1.003	1.000	1.004
SE	0.989	0.989	0.991	0.991	0.996	0.985
SO	0.991	0.991	0.992	0.992	0.997	0.987
SW	0.993	0.993	0.995	0.995	0.996	0.992
AVG	**0.989**	**0.989**	**0.989**	**0.990**	**0.997**	**0.983**

Table 2: Average Values of SF Gas Year 2010/11

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.995	0.991	0.991	0.994	0.999	0.988
NO	0.989	0.988	0.991	0.991	0.997	0.982
NW	0.994	0.989	0.995	0.999	0.999	0.989
NE	0.989	0.989	0.990	0.992	0.998	0.982
EM	0.992	0.989	0.990	0.994	0.998	0.984
WM	0.993	0.991	0.993	0.996	0.998	0.988
WN	0.991	0.990	0.994	0.996	0.999	0.985
WS	0.998	0.996	0.996	0.997	0.999	0.996
EA	0.991	0.989	0.991	0.993	0.998	0.984
NT	0.993	0.992	0.994	0.995	0.999	0.988
SE	0.992	0.990	0.993	0.994	0.999	0.986
SO	0.995	0.993	0.995	0.996	0.998	0.992
SW	0.995	0.994	0.995	0.996	0.996	0.994
AVG	**0.993**	**0.991**	**0.993**	**0.995**	**0.998**	**0.988**

Table 3: Difference Between Average Values of SF in Gas Year 2009/10 and 2010/11

LDZ	MON-THUR	FRIDAY	SATURDAY	SUNDAY	WINTER	SUMMER
SC	0.017	0.017	0.017	0.018	0.004	0.026
NO	-0.004	-0.005	-0.003	-0.003	-0.001	-0.007
NW	0.016	0.013	0.019	0.019	0.002	0.027
NE	0.003	0.002	0.002	0.003	0.001	0.002
EM	0.012	0.010	0.012	0.014	0.003	0.016
WM	0.001	-0.001	0.004	0.005	-0.001	0.001
WN	0.003	0.002	0.003	0.005	0.004	0.001
WS	0.004	0.001	0.002	0.002	0.000	0.005
EA	-0.003	-0.005	-0.003	-0.002	-0.001	-0.007
NT	-0.005	-0.006	-0.004	-0.002	-0.001	-0.008
SE	0.003	0.001	0.002	0.003	0.003	0.001
SO	0.004	0.002	0.003	0.004	0.001	0.005
SW	0.002	0.001	0.000	0.001	0.000	0.002

Table 4: Average Values of WCF – EWCF Gas Year 2009/10

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	-0.094	-0.116	-0.119	-0.116	-0.064	-0.144
NO	-0.044	-0.065	-0.063	-0.053	-0.023	-0.079
NW	-0.072	-0.076	-0.079	-0.063	-0.017	-0.128
NE	-0.044	-0.056	-0.040	-0.025	-0.012	-0.073
EM	-0.043	-0.065	-0.071	-0.055	-0.016	-0.087
WM	-0.074	-0.084	-0.091	-0.091	-0.045	-0.116
WN	-0.053	-0.051	-0.042	-0.039	0.000	-0.099
WS	-0.070	-0.067	-0.081	-0.072	-0.038	-0.104
EA	-0.046	-0.058	-0.044	-0.041	-0.030	-0.064
NT	-0.037	-0.042	-0.021	-0.018	-0.033	-0.032
SE	-0.048	-0.051	-0.033	-0.032	-0.043	-0.045
SO	-0.070	-0.086	-0.087	-0.073	-0.065	-0.086
SW	-0.051	-0.049	-0.051	-0.046	-0.034	-0.066
AVG	**-0.058**	**-0.067**	**-0.063**	**-0.056**	**-0.032**	**-0.086**

Table 5: Average Values of WCF – EWCF Gas Year 2010/11

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	-0.024	-0.032	-0.043	-0.029	0.037	-0.094
NO	-0.052	-0.047	-0.062	-0.036	0.007	-0.107
NW	-0.065	-0.076	-0.059	-0.028	0.017	-0.138
NE	-0.012	-0.005	-0.010	0.018	0.044	-0.056
EM	-0.010	-0.018	-0.028	0.009	0.038	-0.059
WM	-0.033	-0.035	-0.042	-0.003	0.020	-0.081
WN	-0.055	-0.046	-0.031	-0.002	0.043	-0.128
WS	-0.028	-0.033	-0.029	-0.006	0.016	-0.067
EA	-0.025	-0.028	-0.021	-0.007	0.033	-0.077
NT	-0.019	-0.016	-0.003	0.011	0.028	-0.051
SE	-0.030	-0.026	-0.018	-0.006	0.019	-0.068
SO	-0.015	-0.014	-0.011	0.005	0.014	-0.037
SW	-0.028	-0.018	-0.003	0.003	0.012	-0.050
AVG	**-0.030**	**-0.030**	**-0.028**	**-0.005**	**0.025**	**-0.078**

Table 6: Difference between average values of WCF – EWCF in Gas Year 2009/10 and 2010/11

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.070	0.083	0.076	0.087	0.027	0.049
NO	-0.007	0.018	0.001	0.017	0.016	-0.028
NW	0.007	0.000	0.020	0.035	-0.001	-0.010
NE	0.032	0.051	0.031	0.007	-0.032	0.017
EM	0.034	0.046	0.042	0.046	-0.021	0.028
WM	0.041	0.049	0.049	0.088	0.024	0.035
WN	-0.002	0.004	0.011	0.037	-0.043	-0.030
WS	0.041	0.035	0.052	0.066	0.023	0.037
EA	0.021	0.030	0.023	0.034	-0.003	-0.013
NT	0.018	0.026	0.017	0.007	0.005	-0.019
SE	0.018	0.025	0.015	0.026	0.023	-0.022
SO	0.055	0.072	0.076	0.068	0.051	0.049
SW	0.023	0.031	0.047	0.044	0.022	0.016

Table 7: Average Values of WCF Gas Year 2009/10

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	-0.103	-0.132	-0.144	-0.130	-0.016	-0.218
NO	-0.065	-0.081	-0.087	-0.070	-0.004	-0.138
NW	-0.072	-0.080	-0.086	-0.060	0.005	-0.150
NE	-0.053	-0.064	-0.060	-0.043	0.003	-0.111
EM	-0.053	-0.073	-0.089	-0.073	0.000	-0.127
WM	-0.072	-0.077	-0.091	-0.088	-0.012	-0.143
WN	-0.052	-0.054	-0.047	-0.034	0.021	-0.119
WS	-0.068	-0.074	-0.092	-0.072	0.000	-0.145
EA	-0.037	-0.048	-0.042	-0.030	0.010	-0.087
NT	-0.028	-0.031	-0.018	-0.005	0.008	-0.055
SE	-0.039	-0.044	-0.032	-0.021	-0.002	-0.070
SO	-0.062	-0.071	-0.070	-0.058	-0.026	-0.102
SW	-0.049	-0.055	-0.058	-0.047	-0.001	-0.101
AVG	**-0.058**	**-0.068**	**-0.071**	**-0.056**	**-0.001**	**-0.120**

Table 8: Average Values of WCF Gas Year 2010/11

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.064	0.030	0.023	0.056	0.143	-0.039
NO	0.002	-0.012	0.000	0.024	0.086	-0.081
NW	0.005	-0.034	0.000	0.045	0.093	-0.084
NE	0.025	0.003	0.016	0.051	0.109	-0.060
EM	0.025	-0.017	-0.015	0.035	0.108	-0.079
WM	0.017	-0.018	-0.011	0.043	0.102	-0.079
WN	0.007	-0.011	0.021	0.063	0.117	-0.087
WS	0.033	0.006	0.019	0.056	0.107	-0.047
EA	0.021	-0.007	0.006	0.031	0.118	-0.086
NT	0.023	0.002	0.019	0.044	0.111	-0.066
SE	0.018	-0.004	0.010	0.033	0.108	-0.076
SO	0.044	0.023	0.029	0.061	0.123	-0.040
SW	0.039	0.021	0.043	0.073	0.105	-0.021
AVG	**0.025**	**-0.001**	**0.012**	**0.047**	**0.110**	**-0.065**

Table 9: Difference between absolute average values of WCF in Gas Year 2009/10 and 2010/11

LDZ	Mon-Thur	Friday	Saturday	Sunday	Winter	Summer
SC	0.040	0.102	0.121	0.075	-0.127	0.179
NO	0.063	0.069	0.087	0.046	-0.083	0.057
NW	0.066	0.047	0.085	0.015	-0.089	0.066
NE	0.027	0.061	0.044	-0.008	-0.106	0.050
EM	0.028	0.057	0.074	0.038	-0.108	0.049
WM	0.055	0.059	0.080	0.044	-0.091	0.064
WN	0.045	0.042	0.026	-0.029	-0.095	0.031
WS	0.035	0.068	0.073	0.016	-0.107	0.098
EA	0.017	0.040	0.036	-0.001	-0.108	0.001
NT	0.005	0.029	-0.001	-0.039	-0.104	-0.012
SE	0.021	0.041	0.022	-0.011	-0.106	-0.006
SO	0.018	0.048	0.042	-0.003	-0.097	0.062
SW	0.010	0.035	0.014	-0.026	-0.105	0.080

Table 10: Root Mean Square Deviation of SF from 1 Gas Year 2009/10

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	0.0140	0.0077	0.0037	0.0034	0.0038	0.0089	0.0164	0.0432	0.0783	0.0598	0.0394	0.0266
NO	0.0007	0.0013	0.0024	0.0028	0.0036	0.0042	0.0052	0.0089	0.0156	0.0169	0.0091	0.0174
NW	0.0173	0.0082	0.0045	0.0045	0.0028	0.0080	0.0216	0.0519	0.0804	0.0569	0.0283	0.0563
NE	0.0116	0.0060	0.0030	0.0020	0.0012	0.0053	0.0138	0.0290	0.0513	0.0375	0.0174	0.0326
EM	0.0156	0.0082	0.0038	0.0027	0.0019	0.0094	0.0232	0.0447	0.0658	0.0528	0.0287	0.0394
WM	0.0139	0.0051	0.0024	0.0036	0.0034	0.0037	0.0123	0.0332	0.0453	0.0323	0.0252	0.0197
WN	0.0050	0.0072	0.0057	0.0047	0.0059	0.0065	0.0085	0.0209	0.0415	0.0151	0.0075	0.0124
WS	0.0035	0.0024	0.0013	0.0010	0.0013	0.0012	0.0022	0.0109	0.0276	0.0224	0.0077	0.0079
EA	0.0104	0.0053	0.0032	0.0037	0.0034	0.0041	0.0098	0.0208	0.0255	0.0240	0.0118	0.0146
NT	0.0016	0.0008	0.0015	0.0014	0.0014	0.0005	0.0007	0.0024	0.0048	0.0056	0.0108	0.0044
SE	0.0127	0.0069	0.0034	0.0019	0.0023	0.0065	0.0151	0.0218	0.0301	0.0277	0.0101	0.0182
SO	0.0079	0.0044	0.0022	0.0014	0.0028	0.0077	0.0143	0.0196	0.0232	0.0187	0.0074	0.0126
SW	0.0051	0.0035	0.0030	0.0028	0.0033	0.0054	0.0084	0.0145	0.0151	0.0097	0.0041	0.0097
AVG	**0.0092**	**0.0052**	**0.0031**	**0.0028**	**0.0028**	**0.0055**	**0.0116**	**0.0248**	**0.0388**	**0.0292**	**0.0160**	**0.0209**

Table 11: Root Mean Square Deviation of SF from 1 Gas Year 2010/11

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	0.0064	0.0053	0.0066	0.0040	0.0071	0.0100	0.0300	0.0217	0.0231	0.0314	0.0272	0.0271
NO	0.0047	0.0028	0.0025	0.0045	0.0071	0.0097	0.0277	0.0246	0.0290	0.0207	0.0204	0.0283
NW	0.0116	0.0073	0.0079	0.0041	0.0064	0.0112	0.0454	0.0280	0.0313	0.0338	0.0309	0.0418
NE	0.0064	0.0044	0.0031	0.0041	0.0066	0.0097	0.0299	0.0181	0.0277	0.0295	0.0214	0.0348
EM	0.0096	0.0066	0.0056	0.0043	0.0072	0.0114	0.0426	0.0288	0.0254	0.0195	0.0220	0.0404
WM	0.0051	0.0035	0.0019	0.0034	0.0048	0.0076	0.0317	0.0184	0.0195	0.0194	0.0163	0.0288
WN	0.0063	0.0060	0.0059	0.0025	0.0058	0.0079	0.0299	0.0180	0.0259	0.0196	0.0170	0.0304
WS	0.0047	0.0023	0.0019	0.0020	0.0034	0.0053	0.0241	0.0075	0.0131	0.0126	0.0104	0.0178
EA	0.0100	0.0090	0.0050	0.0043	0.0069	0.0092	0.0400	0.0336	0.0189	0.0130	0.0120	0.0305
NT	0.0096	0.0071	0.0052	0.0039	0.0076	0.0094	0.0393	0.0308	0.0197	0.0129	0.0113	0.0210
SE	0.0127	0.0087	0.0056	0.0044	0.0069	0.0080	0.0459	0.0338	0.0209	0.0141	0.0115	0.0281
SO	0.0122	0.0069	0.0043	0.0046	0.0076	0.0101	0.0409	0.0284	0.0174	0.0163	0.0158	0.0225
SW	0.0048	0.0040	0.0030	0.0048	0.0076	0.0099	0.0230	0.0165	0.0111	0.0102	0.0084	0.0138
AVG	**0.0080**	**0.0057**	**0.0045**	**0.0039**	**0.0065**	**0.0092**	**0.0347**	**0.0237**	**0.0218**	**0.0195**	**0.0173**	**0.0281**

Table 12: Difference between Gas Year 2009/10 and 2010/11

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	0.0076	0.0024	-0.0029	-0.0006	-0.0033	-0.0011	-0.0136	0.0215	0.0552	0.0284	0.0122	-0.0005
NO	-0.0040	-0.0015	-0.0001	-0.0017	-0.0035	-0.0055	-0.0225	-0.0157	-0.0134	-0.0038	-0.0113	-0.0109
NW	0.0057	0.0009	-0.0034	0.0004	-0.0036	-0.0032	-0.0238	0.0239	0.0491	0.0231	-0.0026	0.0145
NE	0.0052	0.0016	-0.0001	-0.0021	-0.0054	-0.0044	-0.0161	0.0109	0.0236	0.0080	-0.0040	-0.0022
EM	0.0060	0.0016	-0.0018	-0.0016	-0.0053	-0.0020	-0.0194	0.0159	0.0404	0.0333	0.0067	-0.0010
WM	0.0088	0.0016	0.0005	0.0002	-0.0014	-0.0039	-0.0194	0.0148	0.0258	0.0129	0.0089	-0.0091
WN	-0.0013	0.0012	-0.0002	0.0022	0.0001	-0.0014	-0.0214	0.0029	0.0156	-0.0045	-0.0095	-0.0180
WS	-0.0012	0.0001	-0.0006	-0.0010	-0.0021	-0.0041	-0.0219	0.0034	0.0145	0.0098	-0.0027	-0.0099
EA	0.0004	-0.0037	-0.0018	-0.0006	-0.0035	-0.0051	-0.0302	-0.0128	0.0066	0.0110	-0.0002	-0.0159
NT	-0.0080	-0.0063	-0.0037	-0.0025	-0.0062	-0.0089	-0.0386	-0.0284	-0.0149	-0.0073	-0.0005	-0.0166
SE	0.0000	-0.0018	-0.0022	-0.0025	-0.0046	-0.0015	-0.0308	-0.0120	0.0092	0.0136	-0.0014	-0.0099
SO	-0.0043	-0.0025	-0.0021	-0.0032	-0.0048	-0.0024	-0.0266	-0.0088	0.0058	0.0024	-0.0084	-0.0099
SW	0.0003	-0.0005	0.0000	-0.0020	-0.0043	-0.0045	-0.0146	-0.0020	0.0040	-0.0005	-0.0043	-0.0041
AVG	**0.0012**	**-0.0005**	**-0.0014**	**-0.0012**	**-0.0037**	**-0.0037**	**-0.0230**	**0.0010**	**0.0170**	**0.0097**	**-0.0013**	**-0.0072**

Table 13: NDM Weather Corrected Demand as % of NDM Seasonal Normal Demand Gas Year 2009/10

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	93.7%	93.5%	98.5%	97.7%	92.8%	95.7%	91.9%	88.7%	91.0%	83.5%	91.8%	100.2%
NO	98.0%	98.7%	103.8%	103.4%	102.8%	102.4%	98.0%	94.6%	98.9%	95.4%	90.4%	97.4%
NW	98.9%	98.7%	101.7%	105.3%	102.9%	101.2%	94.2%	93.1%	99.8%	105.3%	103.3%	100.8%
NE	98.2%	102.7%	103.8%	106.8%	103.7%	101.8%	99.6%	99.1%	102.4%	108.6%	103.3%	102.4%
EM	95.9%	99.3%	101.3%	103.3%	100.8%	100.8%	96.2%	93.8%	102.8%	108.3%	105.2%	101.0%
WM	95.1%	98.3%	101.2%	104.2%	101.0%	100.8%	94.5%	92.9%	99.1%	104.0%	102.0%	101.5%
WN	92.2%	95.2%	99.8%	104.2%	102.1%	101.7%	93.4%	88.2%	91.5%	92.8%	86.6%	90.1%
WS	94.2%	99.4%	102.5%	105.5%	101.6%	99.7%	88.7%	92.2%	87.0%	97.7%	104.5%	100.1%
EA	95.6%	99.1%	99.8%	102.3%	103.3%	100.8%	95.3%	98.5%	106.4%	106.4%	104.4%	96.9%
NT	95.3%	99.8%	101.0%	104.5%	103.1%	102.0%	96.1%	100.9%	103.7%	102.0%	100.8%	100.0%
SE	94.1%	98.0%	99.2%	102.0%	100.0%	101.2%	95.5%	103.2%	104.1%	108.5%	107.0%	98.6%
SO	98.5%	100.8%	102.8%	101.8%	91.5%	91.7%	82.7%	94.5%	98.2%	104.5%	107.7%	97.0%
SW	94.4%	99.3%	101.3%	106.4%	102.0%	103.7%	93.0%	92.4%	100.0%	106.3%	105.2%	100.7%

Table 14: NDM Weather Corrected Demand as % of NDM Seasonal Normal Demand Gas Year 2010/11

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	103.1%	103.0%	106.2%	104.3%	102.3%	100.1%	92.8%	93.2%	95.5%	100.5%	104.8%	104.0%
NO	99.8%	99.2%	101.6%	102.3%	100.1%	95.5%	90.2%	91.2%	92.8%	89.8%	95.0%	99.7%
NW	95.5%	99.4%	108.4%	102.0%	97.7%	95.2%	91.5%	91.1%	92.1%	92.7%	98.0%	100.6%
NE	97.4%	100.9%	110.7%	104.5%	102.1%	99.2%	94.0%	97.6%	95.0%	98.5%	102.2%	106.3%
EM	98.1%	100.3%	110.0%	104.1%	100.3%	97.8%	93.9%	92.1%	99.2%	107.1%	111.5%	103.1%
WM	98.7%	100.3%	107.8%	104.0%	99.7%	97.1%	93.7%	90.7%	95.6%	98.6%	98.1%	98.9%
WN	91.8%	100.0%	107.5%	104.2%	99.0%	100.0%	94.8%	85.8%	88.4%	87.1%	88.7%	92.9%
WS	94.6%	99.0%	106.8%	103.0%	100.1%	92.9%	87.7%	90.9%	93.9%	96.8%	94.2%	104.6%
EA	99.0%	101.7%	107.3%	103.1%	101.2%	97.6%	94.6%	90.4%	93.9%	104.1%	99.0%	95.3%
NT	100.0%	100.5%	105.8%	102.0%	99.1%	100.6%	95.9%	93.5%	98.9%	103.9%	100.4%	100.1%
SE	98.4%	99.5%	106.2%	101.7%	100.1%	99.9%	95.3%	92.4%	100.0%	105.4%	99.3%	100.3%
SO	98.7%	99.9%	104.1%	101.1%	97.5%	95.5%	94.1%	90.9%	101.8%	109.5%	105.7%	101.4%
SW	100.4%	99.6%	108.7%	103.3%	99.8%	95.5%	93.2%	90.6%	99.0%	105.8%	103.0%	102.3%

Table 15: Aggregate NDM AQs at Start of Gas Year 2011/12

Based on data extracted from the Gemini system for gas days 29/09/11 and 10/10/2011

LDZ	% NDM AQ Change
SC	-0.7%
NO	-2.6%
NW	-1.9%
NE	-0.6%
EM	0.2%
WM	-1.0%
WN	-1.1%
WS	-2.2%
EA	-0.5%
NT	-0.5%
SE	-0.5%
SO	-1.1%
SW	-1.4%
Overall	**-1.0%**