Final Audit Report:

Event audit to identify sources of UFG in respect of Palmerston North gas gate for March 2009 - February 2010

Audit commissioned by Gas Industry Co under rule 66 of the Gas (Downstream Reconciliation) Rules 2008

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1 Background

1.1 Circumstances giving rise to the event audit

The annual UFG factors were calculated for the 2010/11 gas year by the Allocation Agent, and it was found that for a number of gas gates the annual UFG factor is outside the previous cap of 1.035 and floor of 0.985 used during the transition years of 2008/09 and 2009/10.

The Palmerston North gas gate was chosen by Gas Industry Co for an event audit as its annual UFG factor is among the highest of all gas gates (at 1.0626). It is also among the largest gas gates, both in terms of GJs and active ICPs, and is the 4th largest contributor of UFG after Greater Auckland, TawaA and Greater Hamilton.

Rule 46.3.1 shows that the annual UFG factor is determined by dividing the sum of the actual daily energy quantities injected for 12 months by the sum of the best available consumption information for all allocation groups for those 12 months.

The months included in the annual UFG factor calculation are the 12 months up to and including February of the previous gas year. For the 2010/11 gas year, the months are Mar 2009 – Feb 2010 inclusive.

The sum of energy injected at the gas gate was 1019.6 TJs for this period. The sum of best consumption information was 959.5 TJs over the same period. The difference that this audit is investigating is a loss of 60.1 TJs.

1.2 Auditor

GIC commissioned Tetenburg & Associates Ltd to carry out this event audit on 7 February 2011.

Tom Tetenburg is the auditor responsible for this audit. No other persons were used to perform this audit.

1.3 Objective

The objective of this event audit was to investigate the possible cause(s) of excessive UFG at the Palmerston North gas gate (PLN24201) for the consumption periods of March 2009 - February 2010, which impacted on the AUFG calculations to be used for the following gas year.

1.4 Methodology and scope

ICPs examined

The number of ICPs at Palmerston North gas gate is approximately 19,000 (with meters).

In order to make the audit achievable, it was decided to limit the number of ICPs to be examined individually, to those in Allocation Groups 1 – 4 (the registry shows 637 ICPs in these groups). Aggregated data for Allocation Groups 5 & 6 was also examined.

This approach meant that retailers were not asked to provide individual ICP information for an excessively large number of ICPs, which would have been cost-prohibitive and time-consuming to gather. It focuses on those ICPs using greater than 250 GJs per annum.

Scope of the investigation

As anticipated under the Terms of Reference, the following matters were investigated as part of this event audit:

- material under-submission of estimated consumption for non-TOU sites;
- metering set-up errors in billing/reconciliation systems;
- metering equipment malfunctions and/or inaccuracies at gate metering or medium-large commercial sites;
- medium-large commercial sites not being billed;
- medium-large commercial sites incorrectly flagged as de-energised or decommissioned.

These matters were investigated using the following approach:

- gathering data from allocation participants (meter owners, retailers, distribution and transmission system owners) as well as from the gas registry and the allocation system and cross-checking so as to identify any discrepancies. For example, variations between:
    - metering parameters in meter owners' systems and the corresponding parameters in retailers' systems;
    - meter size and measured consumption, where low usage on a large meter can signal a billing factor problem or a metering failure;
    - aggregate as-billed volumes for a retailer compared with submission quantities.
- Wherever possible, in respect of TOU-metered sites, access historical information for the period prior to the Rules coming into force and identify sites that exhibit significant volume changes relative to current-day consumption. Investigate any differences that exist;

- Where considered necessary, arrange site visits where analysis indicates potential anomalies that warrant site investigation to confirm metering set-up and/or malfunction.

1.5 Information provided by retailers

Tetenburg & Associates were appointed as auditor on 7 February 2011.

An information request was sent to retailers on 12 November 2010, at the same time as the request for Greater Hamilton. Data was sought for the period Jan 2009 – Sep2010 inclusive.

While I do not consider that any retailers failed to comply with their obligations under rule 69 to provide information to the auditor, there was a complication regarding obtaining data for EGas, who went into voluntary liquidation just prior to the audit. I believe that sufficient information has been gathered to satisfy the requirements of this audit for the EGas ICPs.

A further complication arose, in that we expected to see most, if not all, of the non-TOU larger meters (ie > AL425) in Allocation Group 4, which was the group we asked for information by individual ICP. When cross-checking with Meter Owner records, we found that we had not received info for many of their larger meters. We had to go back to retailers to ask if these ICPs had been included in their Allocation Group 6 summarised info, and for individual ICP info to be provided.

Also, whilst cross-checking with the Registry ICPs recorded as Allocation Group 4, we found many ICPs for which we did not receive info by individual ICP. Again, we had to go back to retailers to ask if these ICPs had been included in their Allocation Group 6 summarised info, and for individual ICP info to be provided.

This mis-match between which allocation group the retailer has an ICP assigned to, and that recorded on the Registry, has caused major delays in the audit process.

1.6 Draft audit report comments

A draft audit report was circulated by GIC on 27 April 2011 to industry participants for comment, in accordance with Rule 70.

Responses were received from Mercury Energy, OnGas, EnergyDirect, Contact and Genesis.

The comments received were considered in accordance with Rule 71.1, and as a result I have made some changes to the audit report.

2 Findings

2.1 Under-submission of allocation data compared to As Billed data

Unaccounted-for gas can be defined as the difference between the amount of gas purchased and the amount of gas sold through a measured gas distribution system. This difference is commonly described as a percentage of gas purchased.

The sum of a retailer's monthly submissions should tend to the sum of their gas sales, when compared over a long period. Also, as the forward and historical estimates get replaced by more accurate data over time, the final allocation submissions should be closer to the sales.

The accuracy of the submission data is important as it forms the basis of the AUFG factor calculations.

The following table shows the Allocation Group differences in GJs and as a % between the best submission data (final or interim – see notes below the table) and the As Billed data, across all parties, for the 12 months of March 2009 to February 2010 inclusive.

Table 1. Comparison of Best Submission Data and As Billed Data

	GJs	Best Sub as at 1 Jul 10 (See Note 1)	Best Sub as at 1 Apr 11 (See Note 2)	As Billed	Diff Sub as at 1 Jul 10	Diff%
AGCL	All Grp 4	11,169	12,069	12,195	- 1,026	- 8.4%
AGCL	All Grp 6	38,089	40,062	40,781	- 2,691	- 6.6%
CTCT	All Grp 2	21,186	21,183	21,183	3	0.0%
CTCT	All Grp 4	55,793	56,029	58,469	- 2,676	- 4.6%
CTCT	All Grp 6	191,702	192,194	194,212	- 2,510	- 1.3%
EDNZ	All Grp 2	70,165	70,165	70,165	0	0.0%
EDNZ	All Grp 4	43,915	43,906	43,076	839	1.9%
EDNZ	All Grp 6	82,856	82,918	84,496	- 1,640	- 1.9%
EGAS	All Grp 4	1,407	1,581	1,115	293	26.3%
EGAS	All Grp 6	2,518	2,344	2,740	- 222	- 8.1%
EGLT	All Grp 4	59,534	69,617	54,587	4,947	- 9.1%
EGLT	All Grp 6	25,733	15,652	30,171	- 4,438	- 14.7%
GEOL	All Grp 6	17	18		17	0.0%
GENG	All Grp 4	11,394	11,554	12,063	- 668	- 5.5%
GENG	All Grp 6	124,192	123,802	125,614	- 1,422	- 1.1%
GNGC	All Grp 1	130,007	130,472	130,007	0	0.0%
GNGC	All Grp 2	40,366	40,366	40,365	1	0.0%
GNGC	All Grp 4	19,198	19,039	19,026	172	0.9%
GNGC	All Grp 6	433	431	436	- 3	- 0.6%
GNVG	All Grp 2	12,930	12,930	12,726	204	1.6%
GNVG	All Grp 4	10,011	10,005	9,511	499	5.3%
MEEN	All Grp 4	868	863		868	2.7%
MEEN	All Grp 6	6,007	6,015	6,695	- 689	2.7%
Total	1 Jul 10	959,490		969,633	- 10,143	- 1.0%
Total	1 Apr 11		963,216	969,633	- 6,417	- 0.7%
	AllGrp1,2	274,653	275,115	274,447	206	0.1%
	All Grp 4	213,288	224,665	210,040	3,248	1.5%
	All Grp 6	471,548	463,436	485,145	- 13,597	- 2.8%

Note 1: The column, containing best submission data as at 1 Jul 2010, has the 7 months of March 2009 to September 2009 inclusive as final allocation submission figures, and the 5 months of October 2009 to February 2010 inclusive as interim allocation submission figures, due to Rule 46.4.2 requiring the Allocation Agent to calculate and publish the AUFG factors by the 1st business day of July each year. Any subsequent changes from interim allocation submission to final allocation submission figures after 1 July will not be reflected by a change in the AUFG factors applied for the following gas year.

Note 2: The column containing best submission data as at 1 Apr 2011 has the 12 months of March 2009 to February 2010 inclusive as final allocation submission figures. There has been an improvement in difference for the two sets of best submission data, from –10.1 TJs to –6.4 TJs.

By including an additional 10.1 TJs in the AUFG calculations, this would leave 50.0 TJs unaccounted for. The revised annual UFG factor would be 1.0516.

Note also that the Allocation Group 1 & 2, and Allocation Group 4 total data compares very closely. Most of the difference is with the Allocation Group 6 data (as you would expect).

It is not expected that the submission data would match the As-Billed data exactly. The submission data processes should normalise to 365 days, whereas the As Billed could be less than or more than 365 days. The point is that they should converge over the long term. The percentage difference between the early submission data and the As Billed data was –1.0%, which reduced to –0.7% for the later submission data. Changing the submission data used in the AUFG calculations to As Billed would have reduced the annual UFG factor. However, no rule has been breached, as the Allocation Agent must use the best available submission data at the time, for their calculations.

The rules contain processes that allow for more accurate data to be used as further reads come in and/or invoice errors are resolved, over time.

2.2 Registry cross-check

Of the registry's 637 ICPs in Allocation Groups 1 – 4, 142 show as inactive or have the meter removed. This leaves 495 ICPs where retailer data is expected (even if consumption is nil). The Allocation Group 4 audit data requested from retailers was for information at an ICP level. A cross-check found that retailers had not provided audit data for all of these ICPs, as many had been included in retailers' summarised Allocation Group 6 audit data.

This mis-match between which ICPs are shown in the registry as Allocation Group 4 and which the retailers have as Allocation Group 4 in their own systems has caused delays in gathering data for the audit. We were trying to check all the larger meters, and expected that the majority of these would be in the retailers' Allocation Groups 1-4. We have since discovered that many retailers had large meters in Allocation Group 6.

On receiving the individual ICP info from these Allocation Group 6 sites, it was found that many were using more than 250 GJs per annum. Of 31 larger meters (all > AL425 size) in Allocation Group 6 checked, we found that 13 (or 42%) were using over 250 GJs. As a couple of extreme examples, one was using 7.4 TJs p.a, and another 5.4 TJs p.a. The Rec Rules have a requirement that those ICPs using > 250 GJs p.a are put into Allocation Group 3 or 4 (Rule 29.2), and it would appear that this Rule has been breached by some retailers.

Conversely, there are many ICPs using less than 250 GJs p.a. in Allocation Group 4, which have distracted from the focus of the audit. Of the 495 ICPs in Allocation Groups 1-4 , 304 ICPs had meter models of G2000, E602, E610, or E750, which are typically used in domestic connections and some small commercial connections. We were able to analyse consumption history for 72 of these ICPs and found that 58 (or 81%) were using less than 250 GJs p.a. The Rec Rules have a requirement that those ICPs using < 250 GJs p.a are put into Allocation Group 5 or 6 (Rule 29.3), and it would appear that this Rule has been breached by some retailers also.

Retailers must ensure that their ICPs are assigned to the correct Allocation Group, both on the registry and within their own systems, so that the records are consistent, and to ensure that meter reading frequency is compliant with the Rules.

2.3 Conversion to energy (section 2.7 of NZS 5259:2004)

Rule 28.2 provides:

> "Every retailer must ensure that the conversion of measured volume to volume at standard conditions and the conversion of volume at standard conditions to energy complies with NZS 5259:2004 for metering equipment installed at each consumer installation for which the retailer is the responsible retailer."

Section 2.7 of NZS 5259:2004 Gas Measurement covers the Conversion of Measured Volume to Standard Value of Energy. Note that the maximum permissible errors (MPEs) have been changed, due to Amendment No.1, November 2009.

Gas meters only measure the gas volume at the (non-standard) conditions present at the individual gas measurement system. The retailer's billing system contains processes to convert the gas volume to standard conditions, by applying factors for pressure, temperature, altitude, and compressibility. Finally, the calorific value of the gas is applied to convert the gas volume to energy.

Any problems discovered with retailers' conversions within their billing systems would contribute to long-term UFG.

Pressure factor Fp, MPE +/- 1.1%

Metering pressures used in retailers' billing systems differ from Meter Owners' records in 10 of 180 ICPs (largest meters) investigated (5.6%), although most of the differences are in the order of a few kPas. This can still equate to a few percent per ICP, however further analysis may show that the unders balance out the overs.

At one ICP, it was found that the retailer, EGas, was using 14 kPa for the fixed factor metering pressure, when the meter owner records showed 35 kPa.

At 35 kPa, Fp = 1.345423
At 14 kPa, Fp = 1.138169

Fp error = (1.345423-1.138169)/1.138169 = 18.2%

From this, it appears that EGas have exceeded the error limits for pressure correction at this ICP.

The impact on UFG for the 12 month period was to add 417 GJs to an annual bill of 2290 GJs.

By including an additional 0.4 TJs in the AUFG calculations, this would leave 49.6 TJs unaccounted for. The revised annual UFG factor would be 1.0511.

Temperature factor Ft, MPE +/- 1.1%

For Energy Direct, only corrector sites compensate for temperature.
All other sites use 15 degrees Celsius, so the temperature correction factor is Ft = 1.0000. This would lead to volumes being over-allocated in summer months and under-allocated in winter months.

Table 2. Ground Temperature Profile versus 15 degrees

	Ground temp	Ft	Ft error	
Jan	17.3	0.992081	-0.79%	
Feb	17.6	0.991058	-0.89%	
Mar	16.4	0.995165	-0.48%	
Apr	13.9	1.003832	+0.38%	
May	10.9	1.014434	+1.44%	
Jun	8.6	1.022715	+2.27%	
Jul	8.0	1.024898	+2.49%	
Aug	9.0	1.021265	+2.13%	
Sep	10.6	1.015507	+1.55%	
Oct	12.4	1.009105	+0.91%	
Nov	14.2	1.002784	+0.28%	
Dec	16.1	0.996197	-0.38%	

By applying a ground temperature profile to the Energy Direct billing info for Allocation Groups 4 & 6 across a whole year, revised billing results in an increase to the AsBilled of 1.6 TJs (or 1.29%). From this, it appears that Energy Direct has exceeded the error limits for temperature correction, especially during the winter months, at their non-TOU ICPs.

By including an additional 1.6 TJs in the AUFG calculations, this would leave 48.0 TJs unaccounted for. The revised annual UFG factor would be 1.0494.

All other retailers use a profile of ground temperatures across a year, which is used to derive an average gas temperature for the billing period (between reads). Some retailers have a profile of only 12 monthly figures, whilst other retailers have a profile of 365 daily figures.

Energy Direct have been working towards a billing system upgrade which is expected to be completed in the coming months. This upgrade will include the use of ground temperatures.

Joule-Thomson effect

Only two retailers, NovaGas and Auckland Gas Co, are applying Joule-Thomson effect in addition to their base temperature profile. As almost every ICP has an inlet pressure of 350 kPa (as shown in the registry), and a large majority have metering pressures of 35 kPa or lower, then a pressure drop of 315 kPa would result in a theoretical temperature drop of approximately 1.6 deg C (a shift of approximately 0.5% in the temperature factor) below that of the ground temperature profile currently applied.

Adjusting the As Billed data for Allocation Groups 4 & 6 for those retailers not already applying the Joule-Thomson effect, this 0.5% would result in increased billing of 3.2 TJs.

By including an additional 3.2 TJs in the AUFG calculations, this would leave 44.8 TJs unaccounted for. The revised annual UFG factor would be 1.0460.

Energy Direct have been working towards a billing system upgrade which is expected to be completed in the coming months. This upgrade will include the use of inlet pressures and compensation for the Joule Thomson effect.

It should be noted that, even though all but 5 of the registry inlet pressures are set at 350 kPa (the other 5 range from 100 – 240 kPa), we have analysed as part of this audit a TOU site which has gas metering pressure of 800 kPa. This would suggest it is supplied from a high pressure steel gas main.

The ICP number is 0002379542QTEE9. The registry shows “network pressure” of 350 kPa for this ICP, which I suspect is incorrect, as the metering pressure recorded by the TOU is approximately 800 kPa.

The Network owner should review inlet pressure figures, identify connections from high pressure gas mains, update the registry inlet pressure and notify the relevant retailers.

The scope of this audit is limited to the Gas (Downstream Reconciliation) Rules 2008. Therefore I can not allege a breach regarding incorrect inlet pressures, as this needs to be addressed by a participant to the Gas

(Switching Arrangements) Rules 2008, or the Network owner can allege a breach.

Altitude Factor Fa, MPE = +/- 1.0%

Incorrect altitudes are used in two retailers' billing systems (OnGas & Energy Direct). These retailers believed that the height of the gas gate (in metres above sea level) was the figure they needed to adjust to/for, and that this height should be applied to all ICPs supplied by that gas gate. However, it is the height of each individual ICP above sea level that is to be used in the corresponding Fa calculations. The gate volumes are converted for altitude (back to sea level) as part of the conversion to standard conditions and then converted to energy values.

There is a wide range of altitudes (0 – 200m) in the registry for ICPs at Palmerston North, as the following table shows.

Table 3: Altitudes of ICPs at Palmerston North

Altitude (metres)	No. of ICPs
0	2,982
1	1
10	110
21-29	10
30	4,177
31-39	11
40	4,896
41-49	6
50	3,675
51-59	21
60	455
61-69	6
70	343
73	1
80	121
90	26
100	15
109	1
110	1
200	1

For OnGas, using 29 metres fixed for all ICPs is fairly close to the average height, so the resultant errors may not be significant (depending on actual altitude of individual ICPs).

For Energy Direct, only gas gates with heights above 100 metres have altitude compensated for. As the gas gate height is not over 100 metres, there is no altitude compensation applied. Effectively, the height used for all their ICPs is then 0 metres above sea level.

However, application of the correct altitude and altitude factors is required for each individual site.

Energy Direct have been working towards a billing system upgrade which is expected to be completed in the coming months. This upgrade will include the use of ICP level altitude.

2.4 Gate metering

There is one gas gate supplying the Palmerston North network (PLN24201).

We have received copies of the As Found and Calibration reports for the meter and corrector at this gas gate, and are satisfied that these devices were operating accurately during the 12 months under investigation for this audit.

2.5 Meter multipliers

An examination of the monthly consumption data provided for 239 ICPs (largest meters) did not show any sudden step changes at switches, nor were any x 10 variations arising from meter changes detected.

Comparisons of historical TOU data (pre Oct 2008) to recent TOU data did not show any significant changes.

2.6 Meter capacity checks

To check the possibility of under-billing by a factor of ten, the hourly cubic metre capacity of the gas meter was compared to the maximum monthly throughput. This resulted in 21 possible ICPs where the throughput was down in the lower one tenth of the meter's capacity.

Although there are legitimate reasons for a site to use a lower quantity of gas through a relatively large meter, it was decided that these sites should have site visits to check for any discrepancies with the data provided for the audit.

2.7 Site Visits

At 20 of the 21 sites, meter readings were taken and checks confirmed the low usage by these customers.

At one Genesis site, it was found that the meter reader had not been recording the permanent zero at the right hand side of the index dials, which indicates that the index is counting tens of cubic metres. Consequently, the customer was being under-billed by a factor of ten. Instead of using 488.6 GJs over 12 months, they used 4,886 GJs, an additional 4,397 GJs.

By including an additional 4.4 TJs in the AUFG calculations, this would leave 40.4 TJs unaccounted for. The revised annual UFG factor would be 1.0413.

It is also suggested that retailers cross check with the Meter Owner to identify and resolve any discrepancies in number of dials to be read, and where necessary arrange site visits to confirm the correct number of dials.

2.8 Subsequent Checks

Following these site visits, I examined further ICP-level information received from retailers for large meter sites that were initially included in summarised Allocation Group 6 audit information. Analysis highlighted another possible site with a x 10 factor issue. I requested Genesis to arrange its own site visit to check the metering.

It was again found that the meter reader had not been recording the permanent zero at the right hand side of the index dials. Consequently, the customer was being under-billed by a factor of ten. It was also found that at this site, the retailer had been using a fixed factor metering pressure of 3.5 kPa, when the meter owner records showed 35 kPa.

Instead of using 87.6 GJs over 12 months, they used 1,139 GJs, an additional 1,051 GJs. By including an additional 1.1 TJs in the AUFG calculations, this would leave 39.3 TJs unaccounted for. The revised annual UFG factor would be 1.0401.

2.9 Summary of UFG Figures

The following table summarises the UFG figures and corresponding AUFG factors for the 12 months of Mar 2009 – Feb2010 inclusive at the Palmerston North gas gate, including the approximate amounts from significant contributing UFG sources uncovered during this audit.

Table 4. Summary of UFG Figures at Palmerston North

	Mar 2009 – Feb 2010 (TJs)	AUFG factor
Injected	1,019.6	
Best Sub for AUFG calcs	959.5	
UFG	60.1	1.0626
Less AsBilled difference	- 10.1	1.0516
Less incorrect Fp	- 0.4	1.0511
Less EDNZ 15 deg C fixed	- 1.6	1.0494
Less Joule Thomson effect	- 3.2	1.0460
Less index x 10	- 4.4	1.0413
Less index x 10, incorrect Fp	- 1.1	1.0401
UFG left	39.3	1.0401

It should be noted that some of the AsBilled difference has already been resolved by the changes from interim to final allocations, from –10.1 TJs to –6.4 TJs, (an improvement by 3.7 TJs).

There is still a relatively large portion of UFG not found (4.0%).

3 Compliance with the Rules

This section of my audit report addresses the circumstances in which there could be an issue as to compliance with the rules.

However, I note that not every instance of UFG is a material breach of the rules. For example, the rules include processes which allow for some estimation and a certain percentage of error. Over time, however, there are improvements in accuracy as a result of processes set out in the rules for revising allocations.

3.1 Meter Index x 10 Errors

Rule 26.2 provides:

> "26.2 Every allocation participant must provide the information required under these rules in a manner that is:
>
> 26.2.1 Accurate and complete; and
>
> 26.2.2 Not misleading or likely to mislead; and
>
> 26.2.3 Timely."

As Genesis have been using incorrect readings at two large meter sites, and consequently under-billing the end consumers, they have also been under-submitting consumption to the Allocation Agent. These figures for allocation were not accurate.

This inaccuracy in allocation figures appears to breach rule 26.2.1. Accordingly, I conclude that there is a material issue as to Genesis's compliance with this rule.

3.2 Flat 15 degree C Temperature Profile

Where gas temperatures have been estimated to be close to ground temperature, it is not possible to assess whether rule 28.2 has been complied with until the true metering gas temperature for the individual ICP has been ascertained. This would mean monitoring the gas temperature using a certified calibrated temperature probe (traceable back to national standards) at a site over a month, and checking the temperatures recorded only when the gas is flowing.

Where Energy Direct have used a fixed temperature of 15 deg C, it is possible to estimate the error by comparing this flat profile with actual gas temperatures measured at ICPs located around the network.

TOU devices already gather such data and so provide a valuable cross-check to the temperature factors being applied at fixed factor sites such as those in Allocation Group 4. Note also that these correctors have to be calibrated in certified laboratories, so the temperature probes' accuracies are traceable back to national standards.

Table 5. TOU average temperature measured in June 2009

TOU	Temp (deg C)	Pressure (kPa)
1	9.19	140
2	11.62	38
3	6.63	40
4	11.74	790
5	10.85	35
6	9.00	104
7	9.57	22
8	8.90	37

I suspect that the inlet pressure at TOU #3 is very high, as the metering temperature is very low compared to the other TOU devices. This is an example of the Joule Thomson effect in action.

You can also see that there is quite a range of gas temperatures, as each gas measurement system can have a number of factors influencing the temperature.

Compare the 10.1 degrees C average of the other 7 TOU sites for June 2009, with the 8.6 degrees C ground temperature figure (from Table 2), and you can see that this is not an exact science. However, using a flat 15 degrees C profile even compared to the higher of these two figures still results in an error which exceeds the NZS52529 maximum permissible error of +/- 1.1%.

At 8.6 deg C, Ft = 1.022715, error = +2.27%
At 10.1 deg C, Ft = 1.017299, error = +1.73%

From this, it appears that Energy Direct have exceeded the error limits for temperature correction at their non-TOU ICPs, although it is difficult to quantify exactly the amount of under-submission. In section 2.3 above, by applying a ground temperature profile to the Energy Direct billing info for Allocation Groups 4 & 6 across a whole year, revised billing results in an increase to the AsBilled of 1.6 TJs (or 1.29%).

This inaccuracy in allocation figures appears to breach rule 28.2. Accordingly, I conclude that there is a material issue as to Energy Direct's compliance with this rule.

3.3 Other matters considered

As Billed Difference

As mentioned above in 2.8, some of this difference has been resolved as the interim allocation submission figures were updated to final allocations.

This process is designed to progressively improve accuracy of consumption submissions (for Allocation Groups 3 through 6) as successively greater proportions of data are based on actual meter reads.

In instances where retailers still have a sizeable under-submission compared to their As Billed figures, it is recommended that they examine further their processes for deriving the submission figures and/or As Billed figures.

The rules call for AUFG calculations using submission data, not As Billed data. No rule has been breached, therefore there can be no material issue.

Metering pressures

Rule 28.2 (stated previously in section 2.3 above) relates to retailers converting volumes to energy using NZS 5259:2004.

Where retailers have been using a different metering pressure to that of the Meter Owner, it is not possible to assess whether rule 28.2 has been complied with until the true metering pressure for the individual ICP has been ascertained.

This may only be possible through site visits by qualified personnel with certified calibrated gauges (traceable back to national standards). However, some changes, for example from a metering pressure of 2.0 kPa to 2.5 kPa, do not exceed the +/- 1.1% maximum permissible error for pressure factor accuracy. Changes from 2 kPa to 7 kPa would exceed the limit, as would the change at the site mentioned where a retailer had 14 kPa and meter owner had 35 kPa.

The overall effect on UFG by these incorrect metering pressures may mean that the unders balance out with the overs.

Joule Thomson effect

The Joule Thomson effect is a physical effect of a gas pressure drop causing a corresponding gas temperature drop. By choosing to not compensate for this effect, some retailers are contributing towards the overall gate UFG.

The 3.2 TJ lost in this manner for one year is a significant amount, although this is spread across seven retailers. However, by applying only the ground temperature profile (already an estimate) and not combining this with an individual site temperature drop (another estimate) does not necessarily mean

that the +/- 1.1% maximum permissible error for temperature factor accuracy has been exceeded.

Altitude factors

Where incorrect altitudes have been used, it is not possible to assess whether rule 28.2 has been complied with until the true height above sea level for the individual ICP has been ascertained, and the difference between altitude factors can be calculated.

$$Fa = 1 - ((h/8500)/Fp)$$

where h = altitude of ICP above sea level in metres,

Fp = (101.325 + metering pressure)/ 101.325 and metering pressure is in kPa (gauge)

The height h is the altitude in metres of each ICP metering installation. Adjustments for altitude are to convert the volume back to that which the volume of gas would be at sea level.

A retailer has used a height of 29 metres, when the range of ICP heights in the registry for Palmerston North is from 0 to 200 metres (however the majority are from 30 to 50 metres). The differences, even at low metering pressure sites, will be minimal.

In any case, I do not consider the findings with regard to metering pressures, Joule Thomson effect, and altitude factors to be material issues or to have materially contributed to UFG at the Palmerston North gas gate. However, these are areas where retailers must ensure they are complying with NZS 5259:2004 for each individual ICP, and where amendments in methods used can lead to an improvement in the percentage of UFG, and improved accuracy of billing for the end consumer.

Rule 75. Responsibility for audit costs

Rule 75.2 provides:

> "75.2 In relation to an audit under rule 66, the following provisions apply:
>
> 75.2.1 If the auditor concludes that a material issue has been raised in relation to compliance with these rules, the allocation agent or the allocation participant to which the material issue relates must pay the costs of the auditor, and if the material issue relates to more than one person, then each person must pay the costs of the auditor in such portions that reflect their contribution to that material issue as determined by the auditor; and
>
> 75.2.2 If the auditor concludes that no material issue has been raised in relation to compliance with the rules, the costs of the auditor must be apportioned between such of the allocation agent and allocation participants, as the case may be, as the industry body determines in its sole discretion."

The Terms of Reference for this audit require me to provide certain information in relation to the allocation of audit costs under rule 75. I provide the following information (as to whether there is a material issue or issues) in accordance with the format in the Terms of Reference:

I have determined that the understating of allocation figures (submitted to the Allocation Agent) by Genesis is a material issue as to Genesis's compliance with rule 26.2.1. The data was not accurate, and this contributed approximately 5.5 TJs of UFG towards the AUFG calculation.

I have also determined that the understating of allocation figures (submitted to the Allocation Agent) by Energy Direct is a material issue as to Energy Direct's compliance with rule 28.2. The data was not accurate, and this contributed approximately 1.6 TJs of UFG towards the AUFG calculation.

- At this point in time, the understating of allocation figures by Genesis and Energy Direct are the only material issues in relation to compliance with the rules.
- Genesis's contribution to the material issue is 5.5/7.1 or 77.5%.
- Energy Directs's contribution to the material issue is 1.6/7.1 or 22.5%.

4 Conclusions

One of the most significant issues arising from this event audit is that Genesis has been understating its allocation figures, due to meter reading problems with indexes counting tens of cubic metres. This equated to approximately 5.5 TJs of UFG for the period of March 2009 to February 2010 inclusive.

Another issue is that EnergyDirect has been applying a flat temperature profile of 15 degrees C for their non-TOU ICPs, rather than applying a ground temperature profile. This equated to an estimated 1.6 TJs of UFG for the period of March 2009 to February 2010 inclusive.

The As Billed data that was gathered as part of this audit is very close to the combination of final and interim figures used in the AUFG calculation. The difference was 10.1 TJs or 1.0%.

There are a variety of minor metering and billing system errors by retailers that could potentially be contributing towards the remaining UFG; however, these do not appear to be significant contributors to UFG, as around 39 TJs are yet to be accounted for.

5 Recommendations

The recommendations resulting from this audit are as follows:

- It is recommended that retailers cross-check their information with Meter Owners' records, particularly number of dials and metering pressure.

- It is recommended that Energy Direct include the use of ground temperature profiles in their billing system.

In addition, I also suggest that the following steps be undertaken in due course:

- Retailers should apply Joule-Thomson effect for their fixed factor ICPs, or install correctors at large volume sites so that the actual temperature drop can be applied.

- Retailers investigate any discrepancies identified by meter readers promptly, such as incorrect meter serial number, incorrect number of digits in reading, or negative consumption.

- Network owners to check and populate the registry with correct nominal network pressures, to provide a sound basis for Joule Thomson effect calculations and to be compliant with the Switching Rules.