



MANAGING UNACCOUNTED FOR GAS (UFG) IN THE DISTRIBUTION NETWORK: THE GAS MALAYSIA EXPERIENCE

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1.0 Background

Unaccounted-for gas (UFG) 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: “Percent Unaccounted-For Gas”.

UFG is a global phenomenon that occurred in gas transmission and distribution industry. The figures can be either positive (more gas sold than purchased) or negative (more gas sold than purchased). In either case, it is important to determine what factors are contributing to the UFG. There are two reasons why UFG is a concern; safety and economics factors.

Concern about UFG for safety includes leakage, third party damage and gas theft. These factors contribute to UFG that can adversely affect the safety concern of customers and public. Economically, UFG represents lost revenues that are not recoverable. It is gas purchased from a supplier but not sold to customers.

Gas Malaysia Bhd (GMSB) was incorporated on 16 May 1992 as a sole natural gas distribution company in Peninsular Malaysia. In Dec 2000, the business expanded to include reticulated Liquefied Petroleum Gas (LPG) to industrial, commercial and residential sectors within Peninsular Malaysia. We operate approximately 1,800 km of pipeline across Peninsular Malaysia serving approximately 700 industrial customers, 1,500 commercial customers and 32,000 residential customers.

2.0 Objective

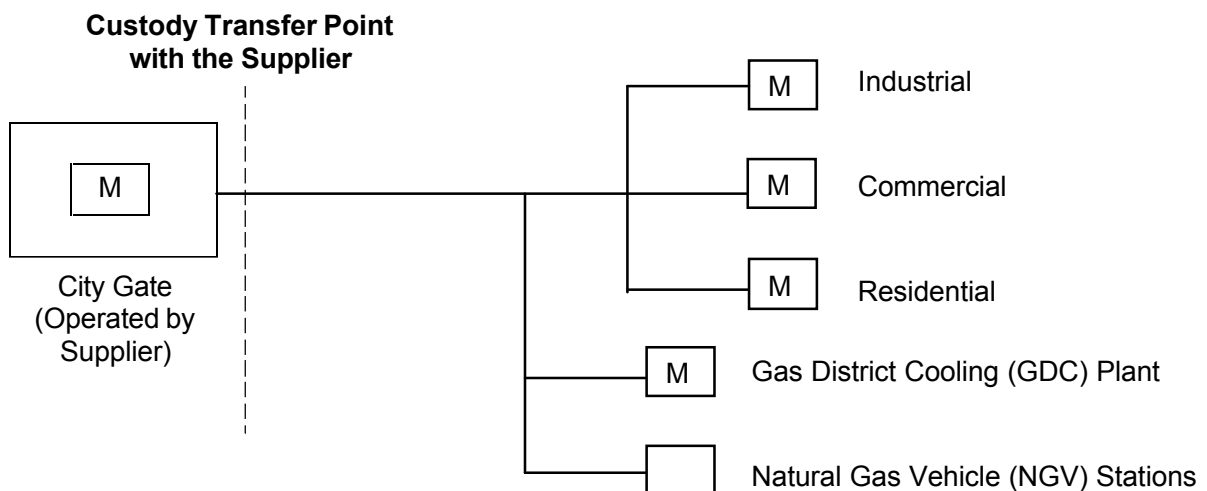
The objective of the presentation is to provide an overview of issues surrounding unaccounted for gas (UFG) in the distribution network and sharing GMSB experience in the management of UFG.

3.0 Method

In GMB, UFG analysis is done on monthly basis to monitor the balance between volumes consumed by GMB customer with the volume of gas purchased from the gas supplier.

To understand on the method taken to study the UFG issue in GMB, it is important to note on the supply concept or distribution system of the company.

In most of the supply are a, GMB network is also been utilized to supply gas to Supplier's customers i.e. Gas District Cooling (GDC) Plant and Natural Gas Vehicle (NGV) stations. The following diagram describes the overall network operations of GMSB.



Gas Malaysia Bhd Distribution Network

The above diagram describes the overall concept of natural gas supply . Gas purchased is billed based on metering system at the metering station operated by the Supplier. This is taken as a volume purchased. While the consumed volume by GMB is an accumulative volume billed at the end user that consist of industrial, commercial and residential customer. Utilization by GDC Plant and NGV Stations is also taken into consideration for UFG calculation, where the billing is carried out by the Supplier.



Volumes are converted to standard condition. Difference between the amounts of gas purchased metered at the City Gate (by Supplier) and the amount of gas sold through a measured gas distribution system (including by Supplier's Customers i.e. GDC Plants and NGV Stations) is taken as the UFG.

The result derived from the comparison made is analysed thoroughly. UFG acceptable variance is set at - 2%. The calculation is made as follows:

Example:

Unaccounted-for-Gas

Gas Sold	45,000 sm ³
Gas Purchased	- 50,000 sm ³

	- 5,000 sm ³

Percentage Unaccounted -for-Gas

Unaccounted-for-Gas	- 5,000 sm ³	
	-----	X 100 = - 10%
Gas Purchased	50,000 sm ³	

For the above illustration, the result is considered as unfavourable to GMB, where the gas sold is less than the gas purchased. Therefore a thorough investigation needs to be carried out to ascertain the root cause of the imbalance.

However if the result is positive (+), where the gas sold is more than the gas purchased, an investigation is also been carried out to look into possible factors that contributed to the positive variance. This is to ensure all factors i.e. meter accuracy, meter reading error, billing /gas accounting system, billing cycle and line pack issue is factored in.

The overall study of UFG in GMB is to ensure safety of supply, network efficiency and accurate billing and metering to customer. At the same time this study is also to ensure accurate billing method is adopted by the Supplier to GMB and vice versa.

4.0 Results

After years of study and constant month to month analysis is been carried out to monitor the UFG in GMB at all supply area , we categorise the operational root cause of UFG as follows :

1. Due to Gas Supplier
2. Due to GMB network operations

4.1 *Due to Gas Supplier*

- Measuring equipment faulty

We have encountered various imbalance between the gas sold and purchased from our Supplier. Various measuring equipment was found faulty during validation activity. This includes pressure transmitter, temperature transmitter, volume corrector and gas meter.

- Billing error
 - Contributed due to human error in key-in billing data information i.e. Gas composition.
 - This resulted to error in conversion factor (CF) calculation.
- Third party billing
 - As mentioned earlier, a part from GMSB customers the Supplier utilized GMSB distribution network to transport gas to their direct customer i.e. GDC Plants and NGV Stations .
 - In this arrangement, GMSB are paid certain fee to transport gas to the related companies. On monthly basis, volume consumed by those companies will be deducted from the total volume of gas at the related distribution network.
 - Since the installation in NGV station is not equipped with a gas meter, operational loss due to purging and compressor activity of NGV station is unaccountable.
 - Since the units of NGV sold are in litre, conversion from litre to sm³ had also contributed to the UFG issue.
 - To resolve the NGV issue, study and discussion has been held with various parties to determine the actual volume utilized by related user. The effort is still on-going.

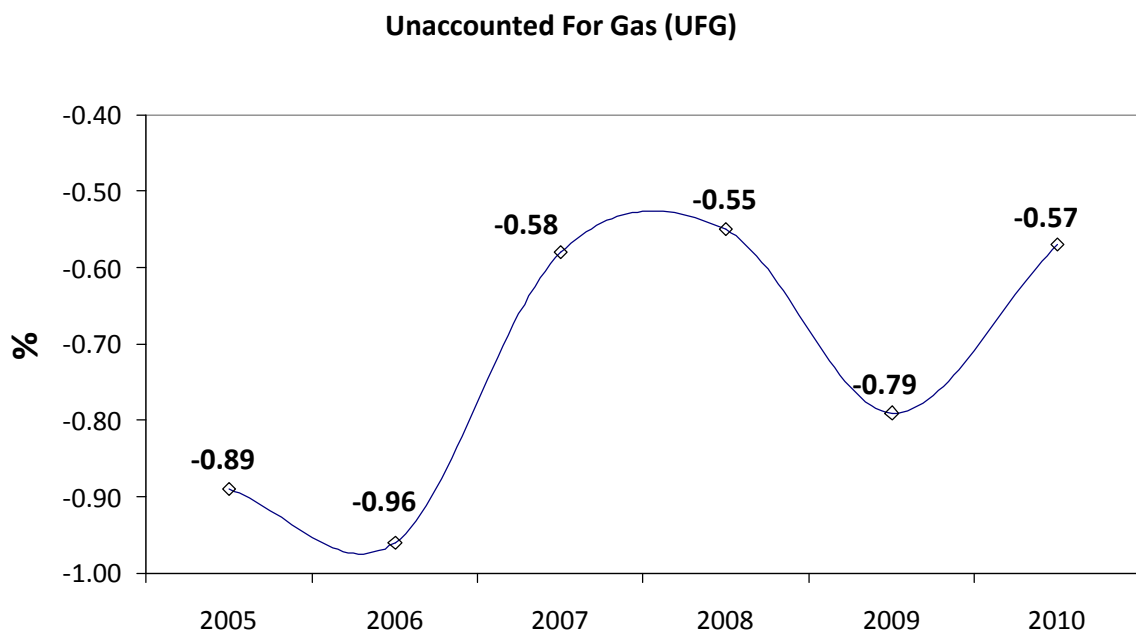


- There are also cases where consumption by related user is not deducted from the billing to GMSB.

4.2 Due to GMSB network operations

- Un-authorized consumptions (theft)
 - Gas theft discovered at various customer within the network.
 - The detection was triggered due to traces of metering facilities been tampered.
 - Abnormal flow is also registered in the analysis made on the customer consumption trending.
- Metering system
 - Metering inaccuracy due to meter internal parts faulty.
 - Cases related to inaccurate sizing of gas meter is also detected in the network. This resulted to flow below meter Q_{min} could not be detected.
 - There are also cases where the volume corrector produces inaccurate conversion due to equipment faulty.
 - Installation of volume corrector in large consumption customers had further improved the gas measurement process.
 - In GMSB, customer with a consumption of more than 50,000 MMBtu will be equipped with volume corrector. Prior to 2004, customers mainly charged with a fixed pressure and temperature factor.
 - However after installation of the corrector, the billing accuracy had improved due to improvement in the gas volume measurement mechanism. Currently 94% of supplied volume in GMSB is measured through the volume corrector.
- Network operations
 - It is also encountered that the gas loss is contributed by leakage along the network system. Causes of leaks on the system might be: improper assembly or maintenance, faulty materials, damaged equipment, corrosion and damage by third party.

The study of UFG issue in GMSB had managed to improve the efficiency of distribution network. Based on the following graph, trending for 6 years had shown improvement in the overall UFG rate in GMSB.



This is achieved as a result of constant monitoring and measures taken to minimize the UFG. At the same time the exercise had managed to improve safety and economic aspect of the distribution network.

5.0 Conclusion

Constant and continuous monitoring of UFG shall be carried out in order to efficiently monitor presence of UFG in the distribution network. UFG detected shall be systematically investigated. Once a thorough investigation is completed, then appropriate steps shall be taken to correct the problems.