2021-10-07

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Recommended Citation

Chavan, U. & Reynolds, A. (2021). The design and impact of Unaccounted for Gas reduction policies for natural gas distribution network in Ireland and the United Kingdom. *Sir Bernard Crossland Symposium 2021 (Trinity College Dublin)*, 22-23rd, 2021. doi:10.21427/5vdw-f770

Funder: Technological University Dublin & Gas Networks Ireland

The design and impact of Unaccounted for Gas reduction policies for natural gas distribution network in Ireland and the United Kingdom

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ABSTRACT

Unaccounted for gas (UAG) is the challenge faced by the natural gas industry which has financial, environmental as well as safety implications. The regulators have the authority to control the extent of the financial costs that can be passed on to the end-users by the transporters and distributors to recover the cost of UAG. There has been action taken by the regulators in Ireland and the United Kingdom to reduce the amount of UAG, which is beneficial to end-users as well as transporters and distributors. This paper discusses the design of the UAG calculation methodology of the distribution network. It highlights the approach taken by the regulators to reduce UAG along with the observed UAG trends in the distribution network.

KEYWORDS

Distribution network, Forecasting and reconciliation process, Natural gas, Unaccounted for gas (UAG)

1. INTRODUCTION

Unaccounted for Gas (UAG) is a challenge faced by the natural gas industry, UAG does not have a standard definition. It can broadly be understood as the difference between gas entering the gas network and gas consumed (1). It is also recommended by Costello (2), it is not suitable to have a standard UAG value. As there is no standard definition and calculation method for UAG using a benchmark value is not sustainable (2). UAG is sometimes referred to as Lost and Unaccounted-for (LAUF) Gas (3). In the United Kingdom (UK), the transmission unaccounted for gas is mentioned as UAG whereas for the distribution unaccounted for gas is termed as unidentified gas (UIG) (4,5).

There are different causes of UAG. The main reasons behind the existence of UAG are pipe leakage (gas escaped from network to atmosphere) and measurement and accounting errors (Gas is in the network and not measured or gas used by end-user but not reported or measured accurately)(2).

There are three impacts of the UAG. First, the financial implication is due to the cost of lost gas along with the excess gas that is purchased to replace UAG. Second, the environmental impact due to higher concentrations of methane in natural gas leads to global warming. The third is the safety aspect due to the possibility of fire from leaked gas. Due to all these negative impacts, it is essential to reduce UAG.

The regulators can provide a hard target approach to tackle the issue of UAG (2). This approach penalises the gas transporter or distributor if the set target for UAG is not met. In absence of a set limit for UAG, all the cost of UAG is paid by the end-users, which is unjust (6). By providing the set target allowance, regulators limit the portion of UAG that is recovered from end-users and excess is paid by the transporters or distributors. This is a financial incentive for the transporters and distributors. The reduction in UAG helps the gas industry by lowering the prices for transporters, distributors as well as end-users.

The natural gas network is divided into two types based on operating pressure, which are transmission and distribution networks. The transmission pipeline operating pressure is greater than 16 bar(g) whereas the distribution pipeline is operated below 16 bar(g). Due to the higher pressures, end-users that are supplied through transmission pipelines are large consumers that either require or can operate at higher such as power stations. The smaller end-users such as households are supplied through a distribution network. The operational methodology and compliances for transmission and distribution networks are different, which leads to a different amount of UAG in the network. Some examples of this is that gas consumed by end-users at transmission network is measured and reported daily, in contrast, distribution network end-users gas measurement requirement is once a month or two months depending on the billing period. This results in a detailed dataset for transmission network is available but comparable dataset for distribution network is not available. Due to a large number of end-users, the problem of missing data and accuracy becomes an issue for the distribution network dataset.

In this paper, both the UAG reduction approach and the UAG calculation method employed in Ireland and the UK for the distribution gas network are analysed.

2. METHODOLOGY

The value of UAG can be the total amount of UAG or percentage UAG, which is defined as the ratio of UAG to the total gas injected into a network. The total UAG values vary for each calculation period which depends on the total gas input. The use of percentage UAG provides the relative value which does not depend on the gas input of the calculation period. Hence, for analysis of UAG, it is more appropriate to consider the percentage UAG.

The regulators in Ireland and the UK are the Commission for Regulation of Utilities (CRU) and the Office of Gas and Electricity Markets (OFGEM), respectively. As mentioned earlier, in the UK gas distribution network UAG is termed as UIG. Henceforth, distribution UAG and UIG are referred to as UAG. The detailed process of calculation of UAG and the UAG allowance policies undertaken by CRU and OFGEM are discussed in the following sections.

2.1 UAG Calculation Method

The UAG is explained using a simple black box concept as shown in Fig. 1. (1,7)

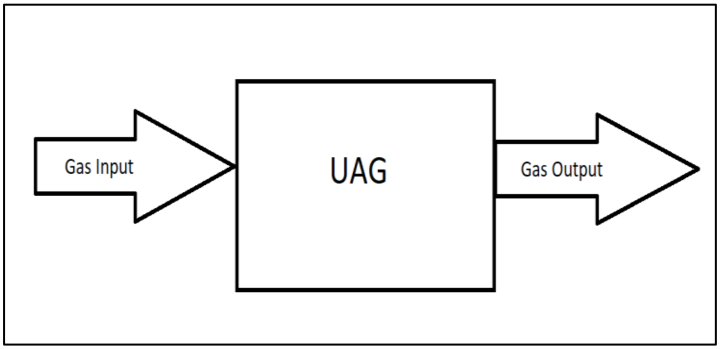

Figure 1: UAG Black Box Concept

The gas input is the measured amount of gas that enters the network. The gas output is the measured amount of gas that is used by either end-users or the transporter and distributors to operate the gas network, which is commonly known as own-use-gas (OUG). The difference between this gas input and output is the UAG.

For the gas distribution network, the following formula is used to calculate the total UAG, as given in Eqn. 1(2)

$$Total\ UAG = R - D - Adjustments \tag{1}$$

where R is the amount of gas injected into the distribution network, D is the amount of gas used by end-users and Adjustment is the umbrella term used to include the gas measured or recovered as part of reconciliation processes and OUG.

A pressure reduction process is required before the injection of gas into the distribution network from the transmission network. Due to operational requirements and safety reasons, the gas is always measured at the injection point. The sum of gas measured at the injection point over the UAG calculation is D. The sum of all the gas consumed by end-users across the calculation period is called R. This is the gas consumption that is paid for by the end-users. End-users pay for the gas based on meter readings and in absence of the meter readings a forecasting and reconciliation process takes place.

The forecasting and reconciliation process is important in distribution network operations as the domestic gas meters may not be read for each billing cycle (typically every two months). These meters without the reads are assigned with the forecasted meter reads based on the history of the meters individually (8). This forecasted value is corrected after the meter read is provided at the later date. The difference between the actual meter read and the forecasted value is referred to as the reconciliation value for the individual meter. The total amount of reconciliation is the sum of all the reconciliation values for the UAG calculation period. This reconciliation process is a daily process and is part of the operation of gas distributors.

2.2 UAG Allowance Policy

The CRU and OFGEM both opted for the hard target approach. A hard target approach is an approach taken by regulators which provide penalise the transporters and distributors if the set target is not achieved. It is in contrast with a soft approach where the transporters and distributors are rewarded when they reach the set target. The regulators set the UAG allowance as a percentage UAG. This percentage is calculated based on the total input amount of gas into the gas network. The total cost of UAG is not passed to end-users. The transporters and distributors can recover the cost of UAG allowance from end-users and excess UAG costs are born by transporters and distributors as a penalty.

CRU set a decreasing UAG allowance for Ireland. They set the UAG allowance at 0.95% for the year 2017-2018, which is decreasing by 0.05% each year until the year 2020-2021 (9). The UAG allowance for the UK was set at a fixed value of 2% by OFGEM in 2018 (10).

3. RESULTS AND DISCUSSION

The analysis of the distribution UAG shows that the regulators have taken proactive steps by setting up reasonable UAG allowance hard targets. There is a difference between the UAG allowance value in Ireland and UK.

Gas Network Ireland (GNI) operates a transmission and distribution network in Ireland. The monetary impact of excess UAG is borne by GNI. The trend of reducing UAG is observed in the annual percentage UAG as shown in Fig 2 even if the percentage UAG still exceeds the CRU set UAG allowance. Starting from 1.56% in 2015, GNI reduced UAG below 1% for the years 2018 and 2019 (11).

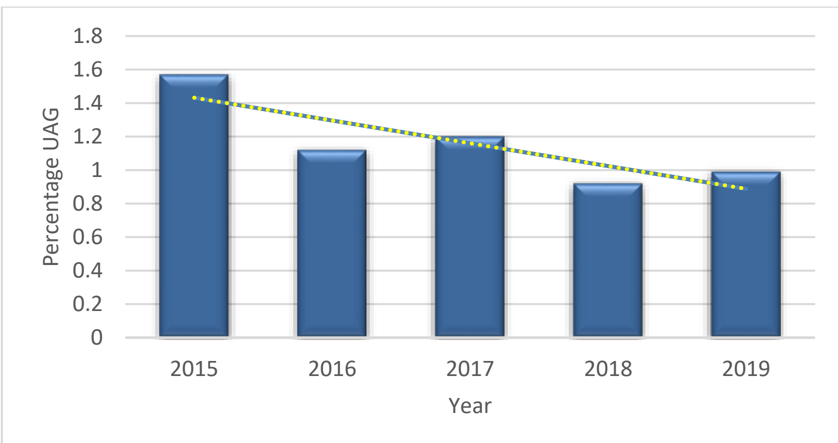

Figure 2: Annual Percentage UAG for Ireland (11)

Xoserve is the central data system provider for the UK. The data for UAG is published as part of their UIG taskforce update. Fig 3 is extracted from the update of January 2020 providing the monthly percentage UAG values. In this figure, the trend of reducing the monthly percentage UIG is observed. The unexpected monthly percentage UAG values are also justified. The reasons provided in the figure are the change in methodology, which impacts the UAG calculation process.

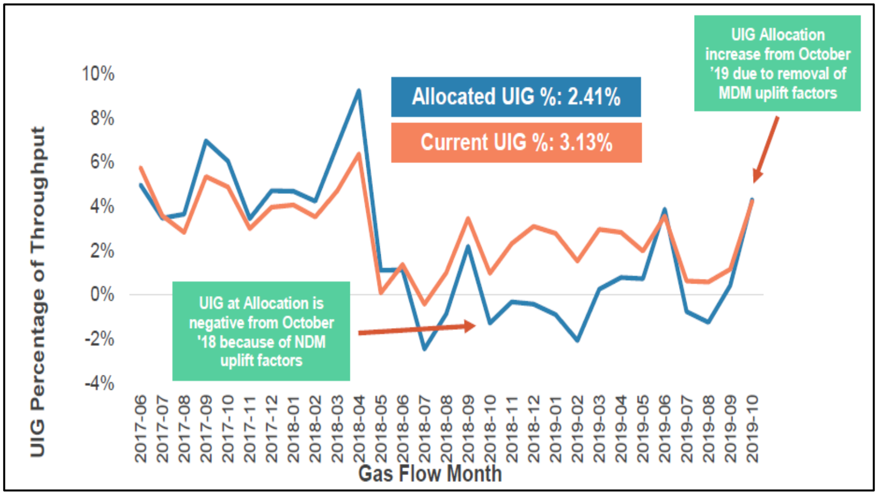

Figure 3: Annual Percentage UAG/UIG for UK (5)

In both Ireland and UK, the percentage UAG value still exceeds the set UAG allowance target but a general positive trend of reduction is observed. This is possible due to the targeted effort by distributors such as GNI which organised the UAG workgroups or task force through which constant monitoring of UAG is done. Efforts are also made by this task force to reduce the UAG to the set UAG allowance.

4. CONCLUSIONS

UAG in a distribution network is partly due to the UAG calculation methodology. It also highlights that the change in calculation method or process impacts UAG as shown in the case of the UK. This work also provides evidence that benchmarking of UAG is not feasible as the UAG allowance can be considered as a benchmark and the regulators opted for different values. This is due to the difference in UAG calculation methodology, forecasting, and reconciliation process, line-pack. UAG can be best compared to the historical values of the same transporter or distributor if there is no change in calculation methodology and process.

The value of UAG can either be positive or negative but never be zero this is due to the calculation method, absence of actual meter reads for the calculation period, gas leakage during the time required to identify and stop the leakage, theft, and unnoticed losses in pipeline line-pack.

Constant monitoring and analysing of UAG can provide the pathway to reduce it. These pathways include more vigilance in meter reading, checks for leakages and theft, upgrade of faulty or old meters, campaigns regarding third-party damage. Regulators play a pivotal role in the reduction of UAG using a hard target approach if they provide the well-designed set target of UAG allowance as proven.

ACKNOWLEDGEMENTS

This work is made possible by funding from Technological University Dublin and Gas Network Ireland.

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