International Journal Of Management And Economics Fundamental
(ISSN – 2771-2257)
VOLUME 02 ISSUE 06 Pages: 5-10
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705)
OCLC – 1121105677 METADATA IF – 5.587

Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ijmef

Research Article

MEASURES TO RESTORE THE LOSS OF NATURAL GAS WHEN ACCOUNTING FOR HOUSEHOLD GAS METERS, NATURAL GAS CONSUMPTION BY THE POPULATION

Submission Date: June 02, 2022, Accepted Date: June 12, 2022,
Published Date: June 24, 2022
Crossref doi: https://doi.org/10.37547/ijmef/Volume02Issue06-02

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ABSTRACT

The article discusses the issues of gas metering with household meters and reveals some factors that affect the accuracy of metering measurements. An analysis of the loss of used gas volume due to systematic faults in domestic gas meters is provided. Some examples show that such problems can cause significant commercial damage to a gas supplier. Measures to address these shortcomings are proposed to increase the economic efficiency of supply companies.

KEYWORDS

Natural gas, gas volume, metering device, structural errors, commercial losses, correction factor, measurement error.

INTRODUCTION

Almost 98% of natural gas consumers, this is mainly in In households, installed household gas meters (BGS), when accounting for the amount of natural gas used, make errors in the measurement. This is due to the existing measurement error (up to 3%), the permissible technical characteristics of the meter, as well as the use of counters in adverse weather conditions and perfect measurement methods (up to 15%). As a result, the amount of gas supplied to the population and accounted for by household meters differs from the volume actually consumed by 3–15%, i.e., the measurement of gas flow is accompanied by systematic errors made by household meters [9-10-11].

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Systematic errors can be identified and corrected. To do this, it is necessary to identify and carefully analyze the sources that can cause an error in each case, and, if necessary, make appropriate adjustments to the measurement results [1-4-22].

MATERIALS AND METHODS

It should be noted that in the consumer's network (population), gas is supplied through metering units for the amount of gas supplied from distribution stations (GDS). The consumption at the metering stations is recorded by electronic devices, which represent the measured amount of gas (Vconst.st.) reduced to 20 °C, according to GOST 8. 586. At the same time, the amount of gas consumed by the population is individually recorded by the metering device according to the actual gas temperature at the time of measurement, since household metering devices generally do not have temperature compensation.

If the volume of gas accounted for by household meters (Vcons.i.BGS) is calculated relative to the price established by the tariff, the monetary value of this amount of gas. However, this cannot include the monetary value of the volume not taken into account due to the allowable measurement error of the meter (up to 3%) and the volume of gas not taken into account due to the measurement error due to the deviation of the temperature of the measured gas from the standard (20 °C) [3-8].

First, the amount of gas actually consumed by the consumer is not exactly taken into account in the meter due to the presence of a systematic error in the meter measurement. Or the volume recorded in household meters (Vcons.BGS), due to the measurement error of the device, differs from the actual consumed volume by ± ΔVxo. Therefore, in order to determine the actual amount of gas consumed by the consumer, it is necessary to add to the volume of gas measured by the meter Vcons.BGS) add the amount of gas (ΔVxo) not taken into account due to the measurement error of the device. Secondly, due to the deviation of the gas temperature and the conditions for measuring it from the standard ones (t \u003d 20 °C), when recalculating the volume of gas measured by the household gas meter under operating conditions to standard, then the value of the gas volume fixed by the meter will differ from the actually consumed by the value of ΔVt. Since, the temperature of the gas depends on what the gas pipes' low pressure are mainly in the open air, at the GDS the gas passes through constricting devices, it also passes through constricting sections (fracturing, gate valves, constricting devices, etc.) existing in the system gas pipelines of the supplier, where due to the formation Rossel effect, the gas temperature differs significantly from the temperature reduced to the standard state (t = 20 °C) by an electronic meter at the GDS, along with this, the gas enters the meters, either cooled by winter temperatures or warmed up by summer heat.

Taking into account the above, we assume that the volume of gas (Vcons.st) supplied to gas pipeline networks is consumed by consumers only through household gas meters, and therefore the volume actually used gas can be expressed as follows:

$$V_{const.st.} - \sum((V_{cons.i.BGS} \pm \Delta V_{xo}) + \Delta V_t) \approx 0, \text{ or}$$

$$V_{const.st.} / \sum((V_{cons.i.BGS} \pm \Delta V_{xo}) = K_t ,$$

here: Vconst.st - gas volume fixed on the supplier's gas meter, with the gas temperature adjusted to standard conditions (20 °C);

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Vcons.i.BGS - the amount of gas recorded by the i-th gas meter (i = 1 ... n);

ΔVxo is the amount of gas not taken into account due to instrument measurement error, m^3;

ΔVt - the amount of gas not taken into account due to the deviation of the gas temperature from the standard;

Kt - correction factor that takes into account at the time of measurement the deviation of the gas temperature from standard conditions (20 °C); ≈ 0 means that there are technological losses in the gas industry.

Therefore, to determine the actual amount of gas supplied to the consumer, it is necessary to multiply the volume of gas measured by household meters by the correction factor (Kt), which takes into account at the time of measurement the deviation of the gas temperature from standard conditions (20 °C,

760 mmHg St.). This coefficient is determined by the following formula (RD 50-213-80, table 2): gas temperature under standard conditions °C.

Tg.r.- absolute gas temperature under operating conditions °C.

tg - gas temperature under operating conditions °C.

Kt - correction factor taking into account deviations of gas temperature from standard conditions (20 °C).

Using the above formulas, we can determine the volume of gas recorded by a household gas meter, measured by taking into account the deviation of the gas and ambient temperature (20 °C) from standard conditions. That is, the fixed volume is underestimated if Tr.g<20 °C, Kt> 1 or the volume is overestimated if Tr.g.> 20 oC, Kt <1. ± ΔVt = Kt •∑(Vconsump. CBG ± ΔVco) - ∑(Vcons.CBGS ±ΔVco).

In almost all gas supply companies, this amount of gas (± ΔVt) is not taken into account when calculating the population, since the gas temperature is not measured by household meters. At the same time, it should be noted that the temperature of the gas supplied to each apartment is taken into account individually, and it is difficult and impossible to calculate the coefficient for the temperature deviation.

From the foregoing, it can be seen that the measurement of the amount of gas by household measuring instruments is accompanied by two errors: this is an error allowed by GOST and the technical characteristics of the gas meter, and an error associated with the deviation of the gas temperature from the standard (industrial electronic gas meters, the gas temperature is measured and automatically reduced to 20 °C) [2-7-12].

Due to this, the volume of gas supplied to the consumer, as a rule, is taken into account less than that consumed by him, the difference can be from 3 to 15%. This means that the gas supplied to the consumer, in monetary terms, will be 3-15% less.

The measurement error indicated in the technical description of gas meters is a known value, it is not difficult to calculate it. For example, The State Standard of Uzbekistan O'zDSt 8.031: 2008 "Fuel and energy [5-20]. Equipping and using metering devices" paragraph 5.4, limits the uncertainty or permissible relative errors in measuring the amount of fuel and energy, in particular, when using gaseous fuel for domestic and other purposes, the measurement error is allowed up to 3% [23].

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The variability of the error caused by the temperature deviation is natural. This error takes a positive value when the temperature is below 20 °C, and a negative value when the temperature is above 20 °C. Nearly 90% of the large volume of natural gas falls on the cold days of the winter season [19].

From which, the positive value of the measurement error due to the deviation of the gas temperature from the standard downwards is significant [6-13].

The loss of these volumes causes serious damage to the economy, so it is important to reflect them in the volumes recorded by consumers' gas meters. To take into account these losses, as well as their monetary value, it would be advisable to study and develop a legally adjusted regulated tariff system and introduce it into production for monthly reflection of the monetary value of losses due to measurement errors in the price of gas. If in this way gas losses are taken into account due to the above-mentioned systematic errors in the measurement of the meter (deviations in the gas temperature from 20 °C and the permissible measurement error), then, naturally, an economic loss (commercial loss) will be prevented [18-25].

RESULTS AND DISCUSSION

The above examples show the obvious that due to the presence of such problems in the enterprise, the supplier will suffer quite significant commercial damage [16-21].

Suppose that in 500,000 households of the conditionally accepted area, natural gas for domestic needs of the population was supplied through household gas meters. The degree of impact on the financial condition of the gas supply sector, the loss of part of the volume of gas accepted on the balance sheet during its delivery to the consumer due to measurement errors, we will consider using the example of an analysis of the activity of a conditional economy in the period from 2016 to 2020.

Analysis of gas losses in 2016-2020 due to measurement error, permissible technical characteristic of household gas meters.

In 2016-2020 due to the measurement error of the meters, gas in the amount of 216 million 063 thousand m^3 remained unsold on the supplier's account, or the commercial loss amounted to 6 billion 386 million 466.7 thousand soums.

Analysis of the unaccounted gas volume by the meter in the autumn-winter periods (2016-2020) due to the deviation of the ambient temperature and, accordingly, the temperature of the gas passing through the meters from standard conditions (i.e. the supplier to the "warehouse" receives gas from the gas distribution station in the amount specified in accordance with GOST 8. 586.1-5.2005, to standard conditions, tg = 20 °C). To show the possible losses when measuring the flow rate of gas with a temperature different from the standard one under operating conditions, the average temperature of the air and, accordingly, the gas, we will conventionally take equal to 0 °C, then according to the above formula, Kt = 1.07322. This means that the volume of gas is underestimated by this value when measured by household meters, when the gas temperature (tg) is 0 °C [17-24].

When household gas meters measure the gas consumed by the population for domestic needs, with a temperature different from the standard, a temperature error appears, which causes an unaccounted volume of used gas (at tg = 0 °C, then ΔVx = 7.3%). Thanks to this, in 2016-2020. there was an imbalance in the volume of gas in the amount of 371

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million 993 thousand m3 (unaccounted volume - ΔVx, m3), from which the commercial loss in the amount of 10 billion 774 million 685 soums remained on the supplier's account.

From the above examples, it can be seen that due to the measurement error made by gas meters, for five years the sales company received a commercial loss in the amount of 17 billion 161 million 151.3 thousand UZS. Or unaccounted gas in the amount of 588 million 056 thousand m3 remained in the warehouse unsold (ownerless) [13-14-15].

CONCLUSION

Thus, due to the presence in the gas industry of the above problems, the supplier largely incurs commercial losses. To eliminate these shortcomings, and in turn to increase the economic efficiency of supply enterprises, it would be advisable to apply the following measures to production:

1. For all consumers, instead of household gas meters, use high-precision electronic gas meters that apply a correction factor for gas temperature and pressure or make calculations according to standards.
2. To develop and implement centrally throughout the country, the procedure for applying a monthly correction factor calculated based on the average monthly temperature and barometric pressure for each climatic zone received from the republican hydrometeorological center, taking into account the gas pressure in the measurement zone.

1. At the same time, it should be noted that the application of a correction for temperature compensation is acceptable if the gas pressure in front of the meter corresponds to a pressure correction factor equal to at least 1 (i.e., the absolute gas pressure at the meter inlet is at least 760 mm Hg. Art.).
2. Introduce a system of monthly adjusted tariffs for the production of settlements with consumers who have household gas meters, based on the average monthly temperature and barometric pressure for each climatic zone (region) according to the Hydrometeorological Center and the average monthly excess gas pressure in front of the meter, fixed by an act drawn up by the representative of the supplier and consumer groups.
3. In order to calculate the gas consumption on the basis of standards and, accordingly, improve the accuracy of the results of primary hydraulic calculations, research institutes should consider recalculating the norms of heat consumption, given in building codes and regulations (4) for conditions with a temperature of 20 °C and a pressure of 0.1 MPa (760 mm Hg). Along with this, also recalculate the norms of heat consumption for cooking and household needs exclusively for the conditions of the Republic of Uzbekistan.

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