Problem of Technical Losses in Natural Gas Distribution and Transportation Systems of Georgia

`According to the law of Georgia "Concerning Power and Natural Gas" the Commission, within the bounds of its authority passes resolution establishing range of standard losses and methodology of their calculation

Total losses of natural gas (difference between received and sold volumes) is made up of both technical and commercial losses

- Commercial losses are made up of inaccurate metering, non-metered usage and other components. These losses are not reflected in the rate.
- Only standard technic losses are reflected in the rate.

Causes of technical losses:

- Almost in every gas distribution entity in Georgia operating conditions of the pipelines is far from adequate. No anticorrosive electrochemical appliences are.

- Depreciation period of 40 years has passed for hundreds of kilometers of the pipeline

- **Despite the fact the number of crashes is decreasing, certain amount of natural gas is still being lost. Because of poor financial condition of the gas entities, timely restoration of the pipeline is ofthen a problem;**

- **Gas entities don't have sufficient material and technical basis. They also lack sufficient emergency storage of spare parts (pipes, locking and regulating equipment, insulation and other materials)**

- **Metering of gas consumed by end-users as well as mutual settlement systems are not set right**

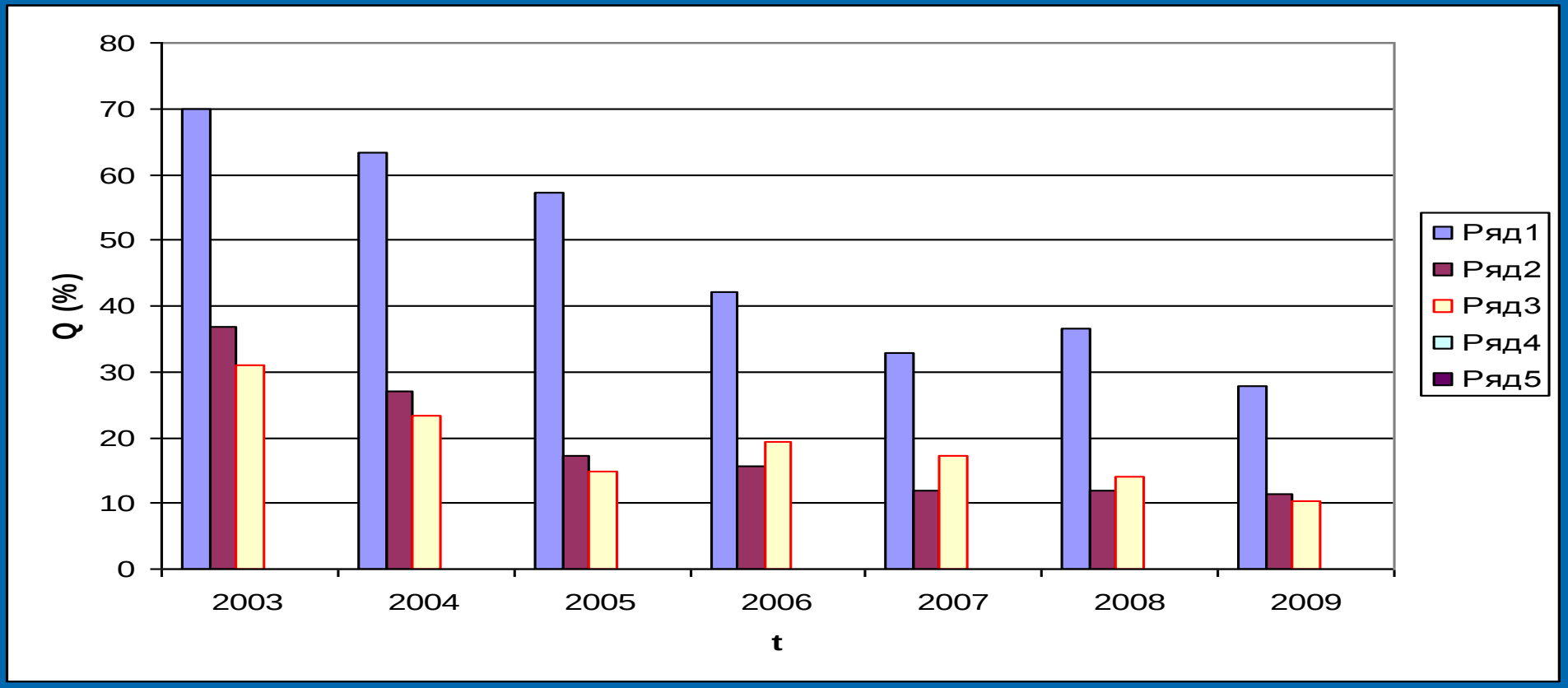
Factual losses

During regulation period in natural gas sector, as well as due to requirements set by the Commission trend of decrease of factual losses (technical and commercial) is evident:

Evolution of factual losses with some of the large and medium distribution licensee (%) in 2003-2009

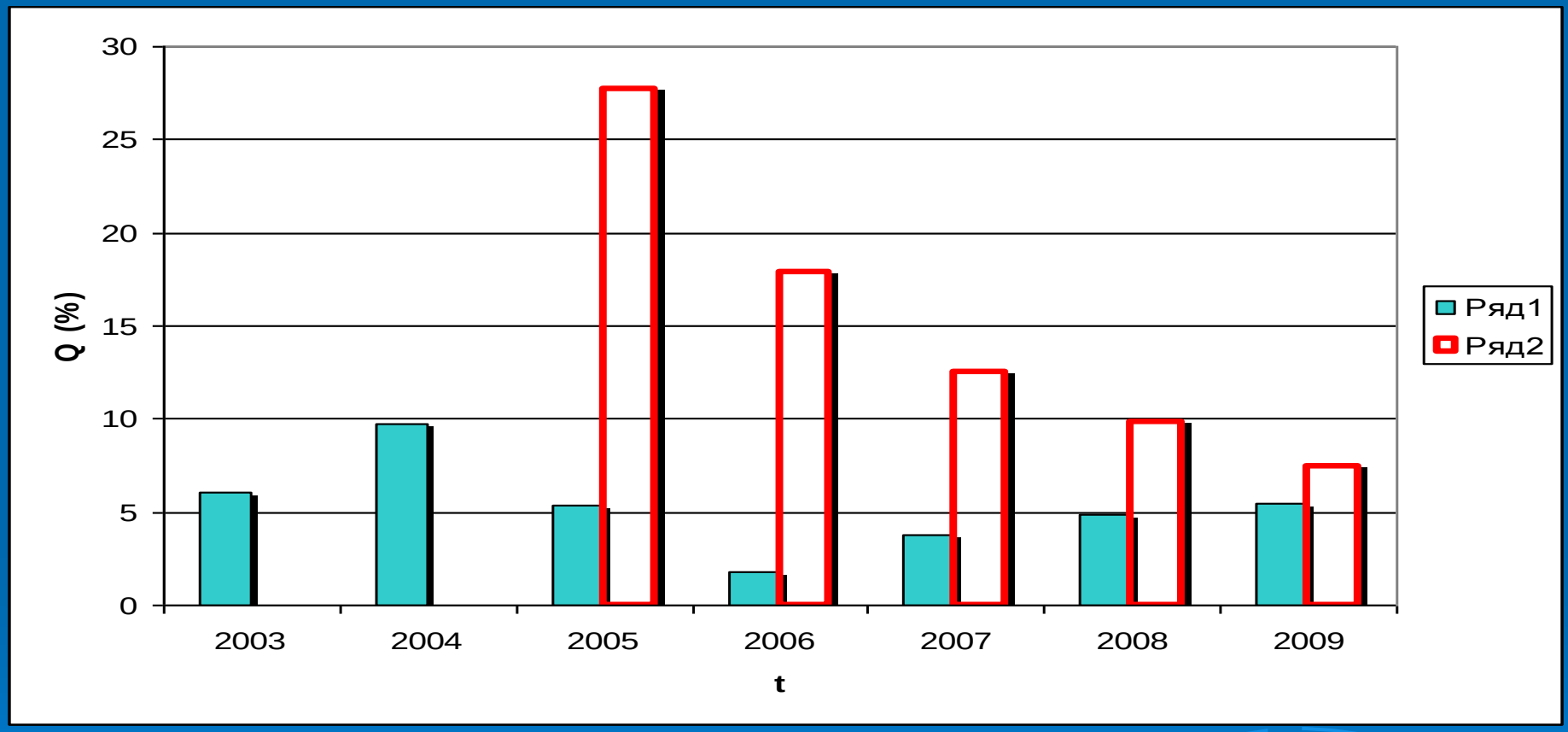
Distribution Licensee	2003	2004	2005	2006	2007	2008	2009
JSC Tbilgazi	69, 9	63,4	57,1	42,0			
Vaztransgaz Tbilisi Ltd				42,0	32,9	36,64	27,72
JSC Rustavigazi	31,1	23,3	14,9	19,4	17,3	14,0	10,86
Samtrediagazi Ltd	36,7	27,1	17,3	15,7	12,0	12,0	11,4
DIdi Digomomi Ltd	6,1	9,7	5,4	1,8	3,6	4,9	5,46
Varketilairi Ltd			27,7	17,9	12,5	9,81	7,51

Note: Since 2006 JSC Tbilgazi as a licensee has been replaced by Kaztransgaz-Tbilisi LTd

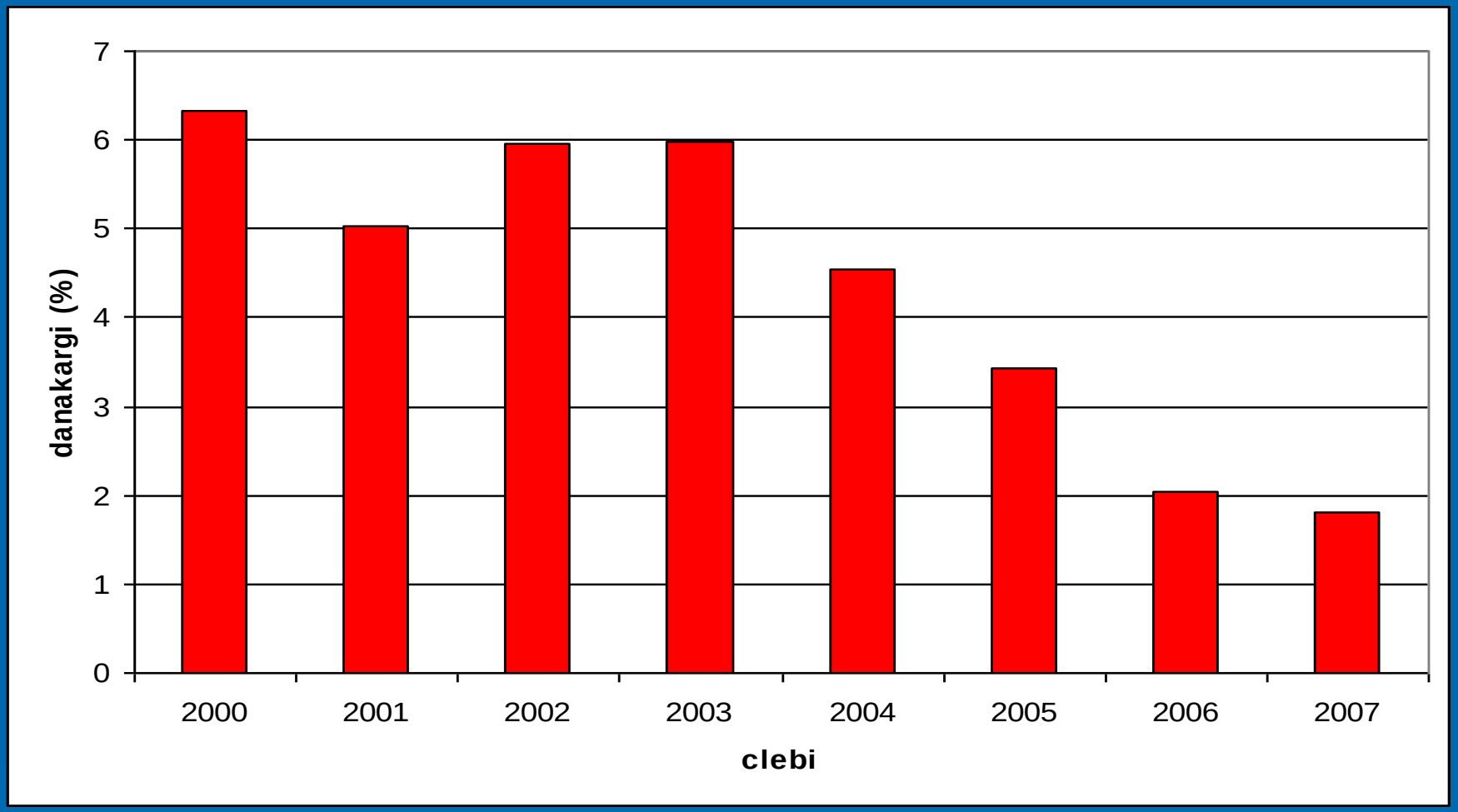


1. **JSC Tbilgazi and Kaztransgaz-Tbilisi Ltd**
2. **Samtrediagazi Ltd.**
3. **JSC Rustavigazi**

Evolution of factual losses with some of the small distribution licensee (%) in 2003-2009



1. **Didi Digomi Ltd**
2. **Varketiliairi Ltd**



Losses in Georgian gas transportation system in 2000-2007

Natural Gas Department has elaborated *Methodology of Technical Losses* Project.

As per this project, standard technical losses in distribution network of the natural gas distribution licensee is to be defined according to the following formula:

$$K = 1 + 4\left(1 - \frac{l}{L}\right)$$

Where _ is standard technical losses of natural gas in distribution networks (percentage of the total volume of gas); _ is the total of lengths of underground and above ground new pipes and underground metal-plastic pipes.

$L = L_1 + L_2 + L_3$ **l**

_ L_1, and L_2 is consequently the length (km) of high, medium and low L_3 presure pipelines

If the length of the distribution network exceeds 1,500 km and annual consumption exceeds 400 m³ then, as an exception, standard losses are to be determined by the Commission through expert assessment, up to 9% (inclusive) of the annual volume of natural gas

Distribution of total losses by low, medium amd high pressure natural gas distribution networks

Total standard losses in natural gas distribution network Q equals sum of total losses in low Q_1, medium Q_2 and high Q_3 pressure networks and is expressed by the following formula:

$$Q = Q_1 + Q_2 + Q_3$$

***Standard* losses in low pressure distribution network equals:**

$$Q_1 = \frac{Q}{1 + n\frac{L_2}{L_1} + m\frac{L_3}{L_1}} = \frac{Q}{1 + 4{,}5\left(\frac{L_2 + L_3}{L_1}\right)}$$

Where n and m are the coefficients of the velocity of the gas eruption from the drilling point
namely ,

$$n = \frac{V_2}{V_1} \qquad m = \frac{V_3}{V_1}$$

ჯვრის V_1, V_2 და V_3 are velocities of the gas eruption from the drilling point for low, medium and high pressures. Since (eruption exceeds critical velocity), than taking into consideration figures, namely $V_2 = V_3$

$V_1 = 92$ **m/s**, $m = n$ $V_2 = V_3 = 415$ **m/s then the result is that** $m = n = 4{,}5$

Standard **losses in medium-pressure natural gas distribution network would equal**:

$$Q_2 = n\frac{L_2}{L_1}\frac{Q}{1+n\frac{L_2}{L_1}+m\frac{L_3}{L_1}} = 4{,}5\frac{L_2}{L_1}\frac{Q}{1+4{,}5\left(\frac{L_2+L_3}{L_1}\right)}$$

Standard losses in high-pressure natural gas distribution networks equal:

$$Q_3 = m\frac{L_3}{L_1}\frac{Q}{1+n\frac{L_2}{L_1}+m\frac{L_3}{L_1}} = 4{,}5\frac{L_3}{L_1}\frac{Q}{1+4{,}5\left(\frac{L_2+L_3}{L_1}\right)}$$

If natural gas distribution doesn't include high-pressure netwroks, then $L_3 = 0,\ Q_3 = 0$ **and standard losses in low- and medium-pressure natural gas distribution networks would equal:**:

$$Q_1 = \frac{Q}{1+n\frac{L_2}{L_1}} = \frac{Q}{1+4{,}5\frac{L_2}{L_1}}$$

$$Q_2 = n\frac{L_2}{L_1}\frac{Q}{\left(1+n\frac{L_2}{L_1}\right)} = \frac{nQL_2}{L_1+nL_2} = \frac{4{,}5QL_2}{L_1+4{,}5L_2}$$

რობლემს ოფ ეტერინგ ინ ატურალ ას შეცტორ

Iნ ცოლდერ რეგიონს ოფ ეორგია წე არე ფაცინგ ტჰე პრობლემ ოფ ინსტალლინგ ინდივიდუალ მეტერს. თჰე ლიცენსეეს ოფ ტჰე ნატურალ გას დისტრიბუტიონ არე პურცჰასინგ ტჰე გას ინ ნორმალ ცონდიტიონს, ბუტ დუე ტო ლოწერ ტემპერატურეს, არე სელლინგ იტ წჰენ იტ ის ცონდენსედ (ე.გ აბნორმალ ცონდიტიონ)

According to law of Georgia Concerning Power and Natural Gas, Article 2, Clause F, *Natural Gas,* or *Gas* is carbohydrate retaining gaseous condition at 1,2 MPA and 20^0C and whose thermal content is no less than 31,8 MJ/m^3 (7,600 kcal/m^3). This condition corresponds to normal (standard) condition for natural gas.

Rates defined by the Commission are based on normal (standard) condition of natural gas

Actual volume of the gas passing through the meter euqals

$$V_n = \frac{293{,}16V_g}{273{,}16 + t_g}$$

Where V_g is volume of the gas registered by the meter and V_n is the actual volume of gas passing through the meter (reduced to normal conditions)

ჩორრექტიონ ცოეფფიციენტ ექუალს:

$$K = \frac{V_n}{V_g} = \frac{293{,}16}{273{,}16 + t_g}$$

For temperatures exceeding 20ºC $K < 1$ ანდ ფორ ტემპერატურეს ლოწერ ტჰან $K > 1$ ით ის

Domestic meters are measuring equipment, therefore all issues related to correction of their readings are wholly under jurisdiction of the National Agency of Standards, Technical Documentation and Metrology

According to rating of domestic meters, if the temperature of the natural gas varies from +17⁰ to 25⁰ correction coefficient equals 1, since inaccuracy caused by temperature changes falls within the range of the meter's own possible inaccuracy

Some of the distribution companies use temperature correction coefficients in their settlement with comsumers

Distribution companies measure temperature of the natural gas either at head meters at the point of reception of gas or in gas-regulating stations where automated temperature measurement equipment is installed

Both methods are unacceptable!!!

Diurnal or monthly averaging practices are equally incorrect since consumption of gas varies during 24 hours period as well as monthly.

Using mentioned practices distribution companies were always better off than the consumers.

Solution has been found through Commission Resolution #17/1 of October 15, 2009 *Concerning Accounting for Natural Gas Consumed Taking into Calculation Temperature Correction Coefficient*

By virtue of this Resolution price of the consumed natural gas should be calculated individually for each settlement based on measurements by individual meter

Or based on measurement of individually installed temperature corrector.

Temperature corrector based settlement should be completed during calendar year in order to fairly factor in, when calculating with the coefficient, all seasonal variations and other individual variables.

It is unacceptable to establish the price for consumed natural gas and settle accounts with the consumer (consumers) using temperature correction coefficient calculated for consumer (group of consumers).

Thank you for your attention!