On the need of adjusting the new rules for connecting to gas distribution networks

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Abstract. One of the important problems in meeting the heat supply needs of housing projects is the gas distribution network construction. The existing rules for connecting to gas distribution networks are constantly undergoing changes and do not provide an increase in the dynamics of gasification in the country as a whole. The article discusses various options for connecting applicants to a medium-pressure gas distribution network. As a result of the studies, it was shown that the refusal to install gas reduction points on the territory of the applicant’s site will have the best effect on increasing the dynamics of the gas distribution network and reducing the connection time for gas consumption networks in the district.

Introduction
Currently, the Russian Federation has new rules for connecting the capital construction projects to gas distribution networks in accordance with Government Decision N1314 of 12.30.2013. For 6 years, work has been ongoing to build the new gas distribution networks and to increase the number of gas consumption networks. As a result of continuous improvement of the legislative framework aimed at developing gasification in the country as a whole, the above-mentioned rules have undergone 15 editions to date. But even after such a volume of work has been completed, the new connection rules in the current edition have been criticized, as they contribute to an increase in regional gasification by only 1% per year [1-7].

It is worth noting that before the entry of the new rules into force, the applicant, the owner of the capital construction object, acted as the customer and, at his own expense, organized the implementation of a full range of works: design and survey with all the necessary approvals, construction and installation works with the restoration of landscaping along the underground gas pipeline, start-up gas to the network of gas consumption and gas distribution. This circumstance did not have the best effect on the natural network gas choice as the main source of heat for the future consumers, often located near the medium-pressure gas distribution network. Basically, the above-mentioned construction and design activities were paid for by the consumers with a large maximum hourly gas consumption, who foresaw the costs of alternative energy sources and were in a bind. As a result of this state of affairs, the construction industry is developing in many areas randomly and the fundamental factor will be the affordable cost of all activities to create a gas distribution and gas consumption network for the full commissioning of the customer’s capital construction facility [8-11].

Materials and methods
The preferential terms of the new connection rules are mainly aimed at the development of existing gas distribution networks of medium and low pressure, which consists in their technical re-equipment, construction of new gas pipelines from the connection point to the existing network and installation of gas reduction points (GRP) on the applicant’s land.

We will consider the options for developing the level of gasification in a single region with an area of 28,000 m², on which there are 20 residential buildings on 1400 m² land plots each provided that the connection is made to the gas distribution network of medium pressure. Let’s say that the applicant at the plot No. 5 enters into the agreement to connect to the gas distribution network of medium pressure for the most common first category with a relatively reduced cost (less than 50,000 rubles in the city). According to the current legislation, in order to fulfill its contractual obligations, the gas distribution organization (GDO) is obliged to carry out a set of measures to create a gas distribution network to the border of the land (not more than 200 meters, measured by the shortest path). The applicant will be required to take the measures to create a gas consumption network of medium and low pressure.

In the first version (Figure 1), a classic approach to fulfill the contractual obligations of both parties will be considered in order to create a medium pressure gas distribution network and a medium and low-pressure gas consumption network. In the prescribed time period (not more than 8 months), the GDO carries out a set of measures to create a gas distribution network from the connection point to the border of the applicant’s land plot on the plot No. 5 (First step). With this option, it is also possible to consider the prospects for further applicants’ connection (second and third stages). At the first stage, the applicant fulfills the obligations to create a gas consumption network inside his land plot No. 5: organizes the work on laying a medium pressure gas pipeline to the GRP, installing the GRP on the territory of his plot, laying the low pressure gas pipeline before entering the capital construction facility, and also provides the device domestic gas supply.

It is also proposed to consider the second option (Figure 2), when an application (plot No. 5) for connection to the only existing medium-pressure gas distribution network is also received by the GDO. After carrying out the preliminary pre-design work and measures to ensure the sustainable development dynamics in the gasified area at the level of gas distribution, a decision is made to install the GRP in the common area and to build a low-pressure gas distribution network to the border of the applicant’s land plot at plot No. 5.

**Results**

When constructing a gas consumption network according to the first option, according to the existing building rules and design standards, two types of GRPs can be installed [12]: with one reduction line, for example, to meet the gas supply needs of one capital construction facility; with two lines of reduction, taking into account the prospect of connecting the additional capital construction projects, both on its own land plot and on neighboring plots. It should be noted in the option with the GPR installation for the future that the difference in the cost of the GRP structures, which provide for a higher consumption of natural gas, implies a payback on the initial investment due to possible compensations when connecting the applicant’s neighbors.

Thus, it is possible to determine the following sequence and order of connections during the stages of the first option: the second stage is implemented after the commissioning of the medium-pressure gas distribution network of the first stage, laid to the border of land plot No. 5 (it is possible to connect the objects in the plots No. 3, 4, 6 from the GRP at the plot No. 5 and facilities at the plots No. 12 and 17); in the third stage, which is also implemented after the commissioning of the second stage gas consumption network, it becomes possible to connect the objects bordering the PWG located in the plots No. 17 and No. 12 (plots No. 15, 16, 18 and No. 9, 10, 11).

The sequence and order of connecting the facilities in the second embodiment passes in the same way as in the first embodiment in three stages, but the restrictions arise only in the absence of the planned low-pressure gas pipeline along the applicant’s border.
Figure 1. The first option for fulfilling the gas distribution network construction obligations

According to the gasification scheme shown in Figure 1, it can be seen that at the first and second stages, the buildings located on 6 land plots are gasified, at the third stage the total amount of plots is 12. The implementation period for each stage connecting to the gas distribution network will be 8 months. Thus, the gasification of facilities located in 12 of the 20 land plots of the district will take 2 years.

Table 1. The results of the medium pressure gas pipeline hydraulic calculation (first option).

| Plot No. | Consumption, m³/h | Length, m | Inner diameter, mm | Initial pressure, $P_1$, MPa | Final pressure, $P_2$, MPa | Pressure drop, $P_1^2 - P_2^2$, MPa |
|----------|-------------------|-----------|--------------------|-------------------------------|-----------------------------|----------------------------------|
| 1        | 2                 | 60        | 100                | 50                           | 0.3                         | 0.3                              | 0.00023 |
| 2        | 3                 | 40        | 100                | 50                           | 0.3                         | 0.3                              | 0.00011 |
| 3        | 4                 | 20        | 200                | 50                           | 0.3                         | 0.3                              | 0.00007 |
| 2        | 5                 | 20        | 200                | 50                           | 0.3                         | 0.3                              | 0.00007 |
Figure 2. The second option for fulfilling the gas distribution network obligations construction

Analyzing the gasification scheme in Figure 2, it can be noted that at the first and second stages, the objects located already on 15 land plots are gasified. At the third stage, gasification of the remaining facilities located on 5 land plots is carried out. As a result, it turns out that the gasification of facilities at 20 sites is fully completed by 2 years.

The hydraulic calculation results, presented in Table 1, show that when designing a medium-pressure gas distribution network with a GRP installed on the applicants’ land plots territory, the full potential of the gas pipeline capacity is not fully revealed. That is, in the first embodiment, the gas distribution network will be more extensive, since the medium-pressure gas pipeline constructed will contribute to the medium-pressure network development even after the considered period for two years.

Table 2. The results of the medium pressure gas pipeline hydraulic calculation (second option).

| Plot No. | Consumption, m³/h | Length, m | Inner diameter, mm | Initial pressure, P₁, MPa | Final pressure, P₂, MPa | Pressure drop, P₂ - P₁, MPa |
|----------|------------------|-----------|-------------------|--------------------------|-------------------------|-----------------------------|
| 1        | 2                | 100       | 50                | 0.3                      | 0.3                     | 0.00056                     |
The results of the hydraulic calculation (Tables 2 and 3) of the medium and low-pressure gas pipeline constructed in the second version indicate the absence of additional measures to increase the pressure in the end sections when connecting all the consumers in the considered area. Also, the second option for fulfilling the gas distribution network construction obligations in the future will contribute to the further neighboring regions’ gasification development.

**Discussion**

In the first embodiment, the number of connections will be less due to the insufficient number of people wishing to ensure the construction of a gas consumption network of medium and low-pressure on their land. Legal issues may also arise if it is necessary to connect to a gas pipeline on the territory of a neighboring section. Therefore, the district’s gasification level development dynamics will directly depend on the coordination availability between the owners of the adjacent sections and the cost of the initial capital costs for the gas supply of the facility.

In the second option, the number of connections will depend on the GRP limit throughput, which the determining factor will be in dynamics of the gasification development in the region. It should also be noted that due to the lower cost of measures to create a gas consumption network, which eliminates the need to install an individual GRP on the territory of each applicant, there will be a magnitude order more willing to conclude a connection agreement. The terms for connecting the applicants will also be reduced due to the absence of the need for additional approvals with the third parties, since all the construction and installation works will be carried out in the common area.

As a result of the lack of a unified approach to the contractual obligations’ implementation on both sides of the contract for connecting to the gas distribution network of medium pressure in the area under

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**Table 3.** The results of the low-pressure gas pipeline hydraulic calculation (second option).  

| Plot No. | Consumption, m³/h | Length, m | Inner diameter, mm | Initial pressure, Pa | Final pressure, Pa | Pressure drop, Pa |
|----------|-------------------|-----------|--------------------|----------------------|---------------------|-------------------|
| 3        | 4                 | 100       | 15                 | 90                   | 2500.0              | 2468.6            | 31.4             |
| 4        | 5                 | 45        | 15                 | 90                   | 2468.6              | 2460.9            | 7.8              |
| 5        | 6                 | 40        | 35                 | 90                   | 2460.9              | 2448.2            | 12.6             |
| 6        | 7                 | 35        | 35                 | 90                   | 2448.2              | 2438.2            | 10.0             |
| 7        | 8                 | 30        | 35                 | 90                   | 2438.2              | 2430.6            | 7.6              |
| 8        | 9                 | 25        | 35                 | 90                   | 2430.6              | 2425.1            | 5.5              |
| 9        | 10                | 20        | 35                 | 90                   | 2425.1              | 2421.3            | 3.8              |
| 10       | 11                | 15        | 35                 | 90                   | 2421.3              | 2419.0            | 2.3              |
| 11       | 12                | 10        | 35                 | 90                   | 2419.0              | 2417.9            | 1.1              |
| 12       | 13                | 5         | 35                 | 90                   | 2417.9              | 2417.6            | 0.3              |
| 13       | 14                | 55        | 135                | 90                   | 2468.6              | 2446.6            | 22.0             |
| 14       | 15                | 50        | 35                 | 90                   | 2446.6              | 2427.9            | 18.7             |
| 15       | 16                | 45        | 35                 | 90                   | 2427.9              | 2412.4            | 15.5             |
| 16       | 17                | 40        | 35                 | 90                   | 2412.4              | 2399.8            | 12.6             |
| 17       | 18                | 35        | 35                 | 90                   | 2399.8              | 2389.8            | 10.0             |
| 18       | 19                | 30        | 35                 | 90                   | 2389.8              | 2382.2            | 7.6              |
| 19       | 20                | 25        | 35                 | 90                   | 2382.2              | 2376.6            | 5.5              |
| 20       | 21                | 20        | 35                 | 90                   | 2376.6              | 2372.9            | 3.8              |
| 21       | 22                | 15        | 35                 | 90                   | 2372.9              | 2370.6            | 2.3              |
| 22       | 23                | 10        | 35                 | 90                   | 2370.6              | 2369.5            | 1.1              |
| 23       | 24                | 5         | 110                | 90                   | 2369.5              | 2369.1            | 0.3              |
consideration, the situation with the development of the gasification level can be different. It will be possible to streamline the development of the gas distribution network when installing the GRP in the common area, which will allow connecting 40% more facilities in 16 months and 2 stages of contractual obligations. The total number of gasified facilities in the GRP presence in the common area will increase by 40% in two years in comparison with the option of installing individual GRP on the applicants’ land plots. The implementation of the above-described measures will affect the gasification development dynamics in the region and the country as a whole.

Summary
To accelerate the gasification of the areas located in close proximity to medium-pressure gas distribution networks, when connecting the applicants, it is necessary to take into account the need to reduce the cost of the connection agreement, the possibility of ensuring the GRP construction and the low-pressure gas distribution network in the common area.

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