Procedure for digitalization of measures to create a gas distribution network

D A Yedukov*, V A Yedukov
Samara state technical university, 244, Molodogvardeyskaya street, Samara, 443100, Russia

E-mail: inbox163@inbox.ru

Abstract. The article describes the possibility of measures digitalization to create a gas distribution network. The description of processes at definition of the contract category on connection, performance and the statement of the design documentation is resulted. The analysis of possible reduction of actions terms at the expense of electronic geodetic database use, a uniform platform on coordination of gas distribution networks projects is carried out. As a result of the introduction of measures digitalization to create a gas distribution network, the contractual obligations term on the part of the gas distribution organization will be reduced to 3 calendar months.

Introduction

At present, the Russian Government is working on an instructions list based on the audit results of the legislative execution aimed at developing regional gasification [1]. This instruction was received from the President of the Russian Federation as a result of unsatisfactory inspection by the Federation Council of the country gasification rate, which currently does not exceed 1% per year [2]. Instructions were also received on the need to ensure digitalization of gasification measures at all levels of executive power and other measures that will have to be phased out by 2024 and 2030 to complete gasification of the country [3, 5, 8].

It should be noted that the new rules for connecting to gas distribution networks are constantly being criticized [3, 6] and adjusted by the Government which number reached 15 in seven years. According to the current regulatory acts of the constituent entities of the Russian Federation and the requirements for construction and installation work in public areas the time period for construction of a gas distribution network to the border of the applicant land plot can be up to nine months [4]. During this period it is required to carry out numerous approvals of the geodetic survey material and design documentation with operating organizations and local authorities. It is also necessary to obtain numerous construction and installation permits in order to legally comply with the possibility of building a gas distribution network in constricted conditions in the vicinity of existing engineering networks. Upon completion of the gas distribution network construction it is necessary to obtain a permit to commission the capital construction facility and make a technological connection with gas commissioning.

Materials and methods
Consider the gasification stages from the application to the approval of the project documentation in order to identify how to reduce the time for interaction responsible decision-making and activities digitalisation.

At the first stage the applicant submits an application for connection to the gas distribution network (Figure 1). At present, this process is ensured by the employees of the gas distribution organisation (GDO) who ensure further review and conclusion of contractual obligations after reviewing the package of documents attached to the application.

The GDO then analyses the possibility of connecting the applicant's capital construction facility in accordance with the requested gas consumption to the gas distribution network and determines the connection point. These data are decisive indicators when drawing up the contract for technological connection and its further conclusion between GDO and the applicant. After conclusion of contractual obligations on connection of the capital construction object to the gas distribution network, exploration and design works are carried out by GDO. In this process the Department of Urban Development, operating organisations and third parties that interests are affected in the course of the gas distribution network construction are involved.

![Figure 1. Existing cooperation scheme at the stage of contracting and design of the gas distribution network](image-url)
It should be noted that if in the existing scheme (Fig.1) the declared volume of consumption does not exceed 500 m$^3$/h such measures as determination of the connection point and the consumption volume when connecting the future consumer before signing the contract for technological connection are not agreed with the Ministry of Energy and the gas distribution organisation (GDO). These data are transmitted to these authorities by the general register as quarterly reports.

Based on the existing model of interaction between the GDO and the main regulator of energy relations (Ministry of Energy) and the natural gas supplier (NGS), it can be seen that the latter two agencies receive information after concluding contractual obligations. This fact reduces the interaction degree at the stage of determining the connection point to the existing gas distribution network.

Results
In order to address the above mentioned shortcomings in the interaction of interested organisations and agencies it is necessary to strengthen the relationship and create a single digital space where all participants in the process will have to work: from identification of the connection place to the existing/reconstructed gas pipeline to construction and installation work in the city.

It is proposed to consider one of the possible options of the procedure for digitalization of the gas distribution network in terms of preliminary definition of the contract category (definition of the gas pipeline connection point) and performance of design works on construction of the gas distribution network (Figure 2).

On the instructions of the Head of State of 31 May 2020 it is necessary to ensure the possibility of applying for connection not only in GDO, but also in numerous multifunctional centres in the country [1]. The instruction implementation will allow increasing the number of centres accepting gasification applications, but will also make it possible to centrally send data on the total number of applications and the corresponding load on the gas distribution network in a particular area to the Ministry of Energy and the Gas Transport Organisation (GTO). This condition will make it possible to monitor in real time the dynamics of possible connections to the existing gas distribution network for further forecasting of measures to increase the capacity of existing gas distribution stations.

In such a way, at the first stage the analysis of possible connection options to the existing gas distribution network is performed. It is necessary to create a single digital space where interaction between the applicant - GDO - GTO - municipal authorities - Department of Urban Planning - operating organisations will be possible.

It should be noted that at present the process of interaction between the abovementioned organisations and the executive authorities is not sufficiently established. Absence of a short normative term for consideration of the laying possibility in the public territory and coordination of design documentation increases the approval time for the construction of gas distribution networks. In the case of constrained construction, many design solutions are not coordinated due to the proximity to existing engineering networks and possible subsequent difficulties in operation, maintenance and repair.

To meet this condition it will be necessary to create a single site to agree the design documentation for the construction of engineering networks including the gas distribution network. Each responsible person of each of the organizations involved will be given a certain period of time to agree or reasoned refusal with recommendations on adjustment of the design decision. In order to increase the degree of responsibility and accuracy in making decisions on coordination of the gas pipeline route it is necessary to create the site basis for coordination of project documentation - current digital tablets of the Department of Urban Planning. These tablets should display capital construction objects and existing engineering communications on the site. Providing information to site participants in electronic form (DWG format) will allow using the possibility of timely changes to the existing location of engineering communications and strengthening the organisation degree when considering design solutions.
Figure 2. Proposed interaction scheme for digitization of measures to conclude the contract and design the gas distribution network

In this way, to implement the digitalisation of the first stage where the contract for connection and execution of design works for creation of a new gas distribution network is concluded it is necessary to create an electronic surveying database containing up-to-date data on location of all existing facilities, capital construction objects and engineering communications. This electronic topographic database must include all interested participants in the process of designing and building the gas distribution network and must be updated in a timely manner.

In addition to coordinating and approving the design documentation for the construction of the gas distribution network the availability of a single digital space will make it possible to discuss the following issues that need to be resolved jointly with the Ministry of Energy and executive authorities:
- construction of a new low or medium pressure gas distribution network to connect new applicants for the area under consideration;
necessity and options for reconstruction of the existing gas distribution network or parallel laying of
the new network;
necessity to carry out measures to increase pressure at the end points (connection, installation of
additional gas reduction points (GDP) on the medium and high pressure network, etc.);
possibility of alternative routes for the gas pipeline in the presence of forest land, constricted
conditions, third party territories.

The adoption of the above decisions when creating new or reconstructing existing sections of the gas
distribution network will directly affect the dynamics of gasification of the region as a whole [9, 10, 11,
12, 13].

The need to implement the Government Decree on the establishment of security zones along the
route of the gas distribution network does not have a good effect on the gasification development
dynamics. Very often in practice it turns out that the owner of a land plot whose interests will be affected
during the design of a gas pipeline or GDP near its land plot refuses to agree the design documentation.
For this reason, the design organisation has to repeatedly change the route of the gas distribution network
or force the installation of a GDP in the applicant’s territory due to the presence of a 10-metre security
zone. In most cases, the Department of Urban Planning and executive authorities are not involved in
resolving such disputed points and the creation of a common electronic platform for the approval of gas
pipeline routes will allow monitoring and timely resolution of such failures and optimisation of
construction and installation costs.

**Table 1.** List and timing of measures from the submission time of an application for gasification to
approval of project documentation for construction of the gas distribution network

| №  | Name of event                                                                 | Duration before digitalization, days | Duration after digitalisation, days |
|----|-------------------------------------------------------------------------------|-------------------------------------|-----------------------------------|
| 1  | Determining the possibility of connection (preparing the technical conditions) to the existing networks taking into account the development perspective | 5                                   | -                                 |
| 2  | Identification of connection point options together with the Department of Urban Planning and executive authorities for the possible development prospects of the region | -                                   | 5                                 |
| 3  | Approval of increase in supply volume with GTO                                | -                                   | 1                                 |
| 4  | Preliminary approval of the pipeline route with operating companies            | 14                                  | 7                                 |
| 5  | Coordination of the pipeline route with third parties                         | 14                                  | -                                 |
| 6  | Coordination of the gas pipeline route with third parties involving the Department of Urban Planning and executive authorities | -                                   | 7                                 |
| 7  | Execution of surveys                                                          | 14                                  | 14                                |
| 8  | Reconciliation of survey results with interested organisations and the Department of Urban Planning | 44                                  | 14                                |
| 9  | Design of the gas distribution network                                        | 14                                  | 14                                |
| 10 | Approval of the gas pipeline route with interested organisations and the Department of Urban Planning | 44                                  | 14                                |
Examination of industrial safety
Transfer of the project work results to the applicant
Approval of project documentation for the gas consumption network

|   |   |   |
|---|---|---|
| 11 | Examination of industrial safety | 14 | 7 |
| 12 | Transfer of the project work results to the applicant | 7 | 1 |
| 13 | Approval of project documentation for the gas consumption network | 14 | 1 |
| Amount | 184 | 85 |

Upon completion of the development stage of project documentation for connection to the gas distribution network it is necessary to obtain in electronic form an approved project with all interested organisations. Then the route plan of the gas distribution network should be sent to the applicant in order to be able to link the connection point at the border of the land plot to the projected gas consumption network.

Discussion
The result of the introduction of the stage digitalization concluding an agreement for the connection and design of a gas distribution network (Table 1) there will be a 53% reduction in the time for implementation of measures allowing for more efficient decision-making on the prospective development of the gas distribution network and an increase in the consistency degree between disparate operating organisations. In order to ensure timely decision-making on approval of project documentation for construction of the gas distribution network it is necessary to ensure a short time for approval at a single electronic site. In this case, the design team of the gas distribution organisation will be able to perform its duties in a short time as the number of approvals with interested organisations operating external engineering networks may reach 12 within the city limits. In addition, in case of simultaneous involvement of the executive authorities in this time-consuming process it will be possible to solve problems by agreement with third parties that significantly regulate the cost and timing of measures for the construction of the gas distribution network.

Summary
The construction dynamics of the gas distribution network largely depend on the consistency degree of the interested organisations involved in making decisions on the location of the connection point and coordinating design decisions. Creating a single digital space and changing the existing approach to project approval measures will reduce the time required to connect capital construction projects to the gas distribution network.

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