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Energy Investment Activity - EIA Project

*Guidelines for the establishment and
development of gas distribution systems in
Bosnia and Herzegovina*

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List of Acronyms

bcm	billion cubic meters
BiH	Bosnia and Herzegovina
d.o.o.	društvo sa ograničenom odgovornošću - eng. Limited Liability Company
DSO	Distribution System Operator
DVGW	Deutscher Verein des Gas und Wasserfaches - German Gas and Water Industry Association
EIA	Energy Investment Activity
EU	European Union
FBiH	Federation of Bosnia and Herzegovina
FERK	Federal Energy Regulatory Commission
FMERI	Federal Ministry of Energy, Mining and Industry
GCV	Gross Calorific Value
HERA	Croatia Energy Regulatory Agency

ISO Independent System Operator
ITO Independent Transmission System Operator
LLC Limited Liability Company
LNG Liquefied Natural Gas
MIER - Ministry of Industry, Energy and Mining
MVTEO - Ministry of Foreign Trade and Economic Relations
NCV Net Calorific Value
RERS Regulatory Commission for Energy of Republika Srpska
RS Republic of Srpska
TSO Transmission System Operator
TYNDP Ten Years Network Development Plan

1 INTRODUCTION

Currently several projects for the development of new gas distribution networks are under discussion in Bosnia and Herzegovina. This includes for example the construction of a distribution network in the Bijeljina area and the planned establishment of a new gas distribution system operator (DSO) in Zenica. In addition, the establishment of further gas distribution networks is considered in relation to the expansion of the current gas transmission network in the south or north of Bosnia and Herzegovina (e.g., the South Interconnection of Bosnia and Herzegovina and Croatia with the route Travnik - Posušje and a branch to Mostar, the North Interconnection of Bosnia and Herzegovina and Croatia with the route Brod-Doboj-Maglaj-Zenica or the construction of a gas transmission pipeline network between Bijeljina and Banja Luka). Furthermore, a number of industrial, commercial and household users located at or close to the existing gas transmission and distribution networks in Bosnia and Herzegovina – currently not supplied with natural gas – could potentially be connected to the existing gas network.

Based on the feedback have received from stakeholders, a need has been identified to describe in detail which steps would need to be conducted to establish a new gas distribution system operator, to develop a gas distribution network, to connect a new distribution network (or new segments of a distribution network) to the gas transmission system and to connect gas users to the distribution network, all of which are provided by these draft Guidelines. These Guidelines are based on a separate report on system development delivered by DNV GL as part of the EIA project for Bosnia and Herzegovina funded by USAID. of the separate report covers the current legal and regulatory framework for the development of gas networks in Bosnia and Herzegovina, the legal framework on EU level relevant for Bosnia and Herzegovina (as Contracting Party of the Energy Community) and the experiences with the framework implemented in Croatia and Serbia. It also identifies possible gaps in the current legal and regulatory framework of Bosnia and Herzegovina and gives recommendations for possible adjustments. The focus of these Guidelines is on the practical steps and procedures, which need to be conducted by municipalities or companies considering to set-up a new gas DSO and to develop a new gas distribution network within the current legal and regulatory framework in Bosnia and Herzegovina and its entities. In doing so, it also provides guidance to existing gas DSO planning to expand their existing gas network and to companies and households considering to connect to the gas distribution network or to increase the capacity of their existing gas connection. Where guidance is not provided for specific elements within the current legal and regulatory framework, these Guidelines provide additional recommendations. Possible adjustments to the existing framework – based on the international practice or the EU gas legislation as adopted for the Energy Community – are however not recommended within these Guidelines, but addressed in the separate report on system development.

Since the focus of this document is primarily on gas distribution, which is currently primarily addressed by the legal and regulatory framework on entity level, an overview of the relevant regulation and needed actions with reference to the according provisions for the Federation of Bosnia and Herzegovina and Republika Srpska is given in the following.

Chapter 2 presents the current procedures needed for the establishment of a DSO company, from the business point of view, is given. This ranges from the legal registration of the company (chapter 2.1), the staffing of the company (chapter 2.2) and the procurement of the required equipment and tools (chapter 2.3), to the definition of the operational procedures (chapter 2.4) and the licensing process (chapter 2.5).

Recommendations for the development of the distribution network are outlined in Chapter 3. The process starts with the definition of potential volumes of gas to be distributed/used (chapter 3.1), based on which the actual planning of the distribution system is conducted (chapter 3.2), the design of the DSO network

defined (chapter 3.3), the public procurement of the necessary equipment and construction work is prepared and executed (chapter 3.4), followed by the actual construction of the network (chapter 3.5) and the commissioning and the start of operation of the network (chapter 3.6).

Chapter 4 describes the procedure for the connection of a new distribution network (or new network segment) to the gas transmission network. It starts with the request for connection and obtaining the conditions for the connection from the transmission system operator (TSO) (chapter 4.1), followed by obtaining the consent for connection to the transmission network by the TSO (chapter 4.2), concluding a connection Agreement between the DSO and the TSO (chapter 4.3) and ends with the construction, commissioning and start of operation of the connection with the gas transmission system (chapter 4.4).

The procedure for the connection of new customers to the distribution network is presented in Chapter 5. As in the previous chapter it starts with the request for connection and obtaining the conditions for the connection from the DSO (chapter 5.1), followed by obtaining the consent for connection to the distribution network by the DSO (chapter 5.2), concluding a connection Agreement between the DSO and the new gas user (chapter 5.3) and ends with the construction, commissioning and start of operation of a newly build connection to the distribution network (chapter 5.4).

2 ESTABLISHMENT OF A GAS DISTRIBUTION COMPANY

2.1 Court registration (legal form, definition of business activities, seat of the company, Board of Directors)

Before starting the conduction of a business activity and establishing a business entity, a registration of the entity is required. Registration of the business entity is a procedure within the competent authorities providing an authorization to perform certain activities in a manner and under conditions prescribed by law. The establishment, operation, management and termination of a business in Bosnia and Herzegovina is regulated by the following laws:

In the Federation of Bosnia and Herzegovina:

- The Law on Companies of the Federation of Bosnia and Herzegovina (Official Gazette of FBiH No. 81/2015)

In the Republika Srpska:

- The Law on Companies of the Republika Srpska (Official Gazette of RS No. 127/2008, 58/2009, 100/2011, 67/2013, 100/2017,)

According to the above-mentioned Laws, a company is defined as a legal entity, which independently performs business activities with the aim of earning a profit. Based on the legislation a company can be established by:

- domestic natural person and legal entities
- foreign natural person and legal entities
- domestic and foreign natural person and legal entities

One of the most flexible form of an enterprise that blends elements of partnership and corporate structures is a Limited Liability Company (LLC) or "društvo sa ograničenom odgovornošću" (d.o.o.).

A limited liability company is established by one or more domestic/foreign natural persons and/or legal entities as the company's members in order to perform certain business activities under a common business name. The limited liability company is liable for all of its obligations with regards to all of its assets. The member (shareholder) of the limited liability company is not liable for obligations of the company, except up to the amount of contracted but non-inserted investment in property of the company. The limited liability company can have a maximum of 50 members. Minimum basic capital is BAM 2,000 (approx. 1,000 EUR).

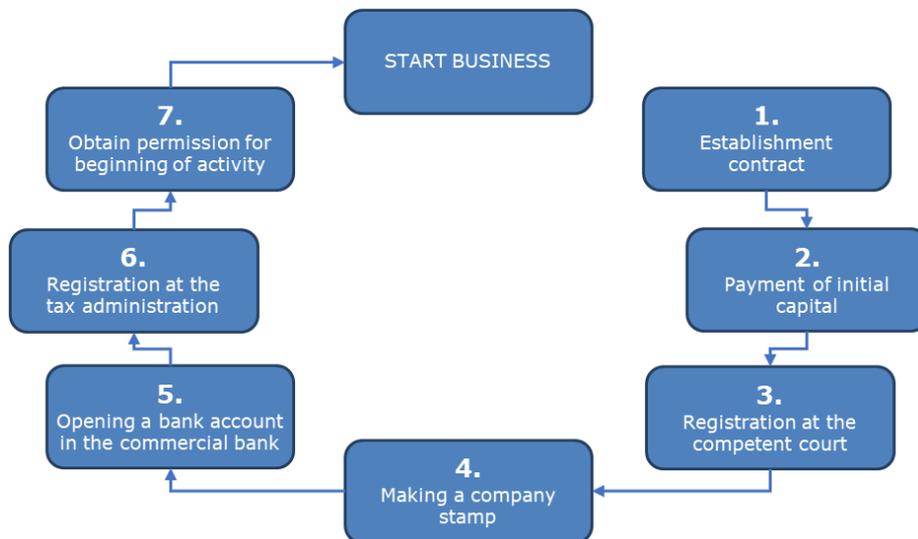


Figure 1: Steps for establishing a business in Bosnia and Herzegovina¹

Public company, in the sense of the Law on Public Companies in the Federation of Bosnia and Herzegovina ("Official Gazette of FBiH", No. 08/05, 81/08, 22/09, 109/12), is a legal entity that is registered in the court register as a company and performing activities of public interest (energy, communications, utilities, management of public goods and other activities of public interest) or a legal entity defined as a public company by a special regulation. Activities of public interest are determined by the municipality, the canton and the Federation of BiH, each within their jurisdiction. Similar rules apply on the public companies in the Republika Srpska, based on the Law on the Public Companies Official Gazette of RS, 75/2004, 78/2011).

According to the Regulation on the organization and regulation of the natural gas sector in the FBiH, the distribution of gas belongs to the energy sector, while according to the Law on Public Utility Services belongs to communal activities (Federation of Bosnia and Herzegovina).

The Law on Communal Activities stipulates that communal activities are of public interest and that they are provided by the municipalities, or, if necessary, by the Canton. The communal activity can be performed by a foreign or domestic legal entity or natural person, following the assignment of the communal activity by the municipality to a legal entity or natural person based on the nature of the communal activities and the conditions and needs of local government in accordance with the law.

The municipality can assign the execution of certain municipal activities financed from the municipal budget to a public company, which has been established by decision of the municipal council to perform the specific communal activities.

¹ Source: How to Establish business in Bosnia and Herzegovina – Internet edition. Available at: <http://fipa.gov.ba/doc/brosure/HOW%20TO%20ESTABLISH%20A%20BUSINESS%20IN%20BH.pdf>

Therefore, according to the provisions of the Law on Public Enterprises in the Federation of BiH, public utility services such as natural gas distribution are performed by public companies.

However, if the public utility company does not possess the appropriate technological and economic resources to perform the entrusted public utility activities or part of certain communal activities, the performance of these activities may be entrusted to another legal entity. The election of another legal entity for the performance of certain utilities financed from the budget is carried out on the basis of the implementation of procedures in accordance with the Law on Public Procurement of BiH.

The concession is the legal instrument by which a public law authority allows a private person to perform certain public works or a public service.

According to the current regulations, the activity of natural gas distribution (municipal or energy activity) could be entrusted to:

- a public company established for the performance of such activities, or
- to another legal entity in case that a public company does not meet the conditions for performing these activities (concession).

Public companies of this Law may be organized in the form of a joint stock company or a limited liability company.

All gas distribution companies with less than 100,000 connected customers are required to separate the financial accounts and the customer data related to its gas distribution business from its gas retail supply activities (accounting and informational unbundling).

Registration of the company shall be done at the municipality court with territorial jurisdiction according to the seat of the company. The seat of the company is defined as the place from which the business of the company is managed. The seat of the company is determined by the founding act and is registered in accordance with the law regulating the registration of business entities.

In case that the company is organized as a public company for performing the communal activities, the following public enterprise bodies are to be established according to the Law on Public Companies in the Federation of Bosnia and Herzegovina ("Official Gazette of FBiH", No. 08/05, 81/08, 22/09, 109/12):

- Assembly – the Assembly takes decisions on the Rules of Procedure or the Offices (on the proposal of the Supervisory Board), the Code of Ethics (on the proposal of the Supervisory Board), the business plan or the revised business plan.
- Supervisory board – the Supervisory board has at least three members. One seat in the Supervisory Board belongs to the candidate with the largest number of votes in the Assembly who was nominated by the shareholder(s) with at least 5% of the shares or the voting right (Art 9 of the Law). The Supervisory Board appoints and dismisses the members of the Management Board.
- Management board – the Management board elects the Supervisory board by a majority of votes on the basis of a public competition. Politicians (persons in the political parties) cannot be elected to the Supervisory board (Art 12 of the Law).
- Audit committee (Art 26 – 29) consist of external experts recommended by Supervisory board and appointed by Assembly, with main tasks to appoint and cooperate with external auditor, to prepare plans for internal and external audits, to prepare periodical reports on financial statements and present them to Supervisory board and Assembly.

2.2 Staffing of company (management, skilled and qualified employees, outsourcing of needed services)

The staffing of the company should consider the relevant energy legislation especially legislation that defines minimal conditions needed to be able to conduct gas distribution services.

A gas company must have an appropriate organizational structure for its technical operations considering the relevant laws, regulations and technical rules, i.e. by applying G and GW series of DVGW² technical rules, which are transposed into the FBiH regulation by adopting the Ordinance on the takeover and application of technical regulations for the area of design, construction, commissioning, exploitation and maintenance of plants and natural gas installations (Official Gazette of the FBiH, 83/08, 4/12, 83/15). In this moment we don't have knowledge on the acceptance of these rules in Republika Srpska.

The gas company must specify in a transparent and clear way and in a written form:

- division of tasks, e.g., the organizational chart
- tasks, competencies and responsibilities of the manager and of heads of units
- rules for the exchange of services between units
- the organization of the emergency service
- chart of authority (specification of the authority for approval by different management levels)

In order to ensure smooth and safe natural gas distribution, according to GW 1200 Technical Regulations, the gas distribution operator is obliged to provide and organize one or more call centers, which can receive a call and immediately forward it to the emergency team for troubleshooting. At the call center at least one person with sufficient professional qualifications must be available 24/7. The call center must be equipped with a connection system (telephone, radio connection, etc.) for receiving, forwarding calls and exchange of information with the reporting person and the services for troubleshooting, as well as other competent institutions.

The gas distribution company must have at least one dedicated team in order to eliminate obstacles and hazards on the gas distribution system promptly and professionally. In case that one team cannot completely eliminate a problem, the gas distribution company needs to organize several duty teams to solve the issue.

In order to address interruptions, health and safety issues, the distribution company, in addition to engaging internal resources, should establish close relationships and may involve external entities as necessary, for example:

- professional legal persons related to the activities of gas distribution,
- firefighters and civilian protection,
- other companies (electricity, water, district heating and telecommunication network operators),
- police,

² DVGW – Deutscher Verein des Gas- und Wasserfaches - German gas and water industry association, acting as an independent and unbiased technical-scientific association since 1859, the objective being to create a basis for the safe and technologically flawless supply of gas and water, whose Technical Rules are widely accepted by industry and regulators/authorities.

- electronic media,
- insurance, and
- railway companies.

To ensure the safe and uninterrupted transmission of data about parameters of the gas system in real time, related to the efficiency, safety and maintenance of gas distribution system, the gas distribution network operator may install a system for telemetric data acquisition – SCADA system.

Regulation for natural gas supply in Sarajevo Canton (National gazette Sarajevo Canton, No. 22/16 Art. 9.) defines for example that the distribution network operator is obliged to establish and maintain the necessary personnel, organizational, material and financial capabilities necessary for the reliable and safe operation and maintenance of the gas distribution system of the Canton Sarajevo, ensuring in particular:

- natural gas supply, according to the energy balance requirements of the Sarajevo Canton, the demand for gas and the issued energy consents,
- planning, organization and operation of the natural gas distribution network,
- adjustment of capacity to changes in the volume and structure of consumption,
- safety and efficiency of supervision and management of the gas distribution system of Canton Sarajevo,
- control, maintenance and development of the gas distribution system of Canton Sarajevo,
- meeting environmental protection requirements,
- professional and technical assistance to existing and potential customers,
- accuracy of measurement of delivered quantities of natural gas, calculation and billing of delivered quantities according to the established tariff system,
- procurement of goods, works and services in order to maintain and secure the gas distribution system,
- investment in replacement of fixed assets,
- complete record of the registered property in the company's account books, in particular assets heaving the character of public good,
- accounting records of all business events, and
- providing financial resources for the purpose of financing the business.

In the Republika Srpska for instance, in the Rules for the operation of the distribution system of Sarajevogas a.d. Istočno Sarajevo, it is prescribed in Chapter II how the company should perform design, construction, operation and maintenance of the gas distribution system, while in the Chapter III the rights and obligations of the Operator of Distribution System (ODS) are defined.

The figure below shows the organizational chart of Sarajevogas d.o.o, in line with the mentioned regulation. Sarajevogas has about 300 employees and distributes an annual consumption of natural gas of about 126 mcm/y.

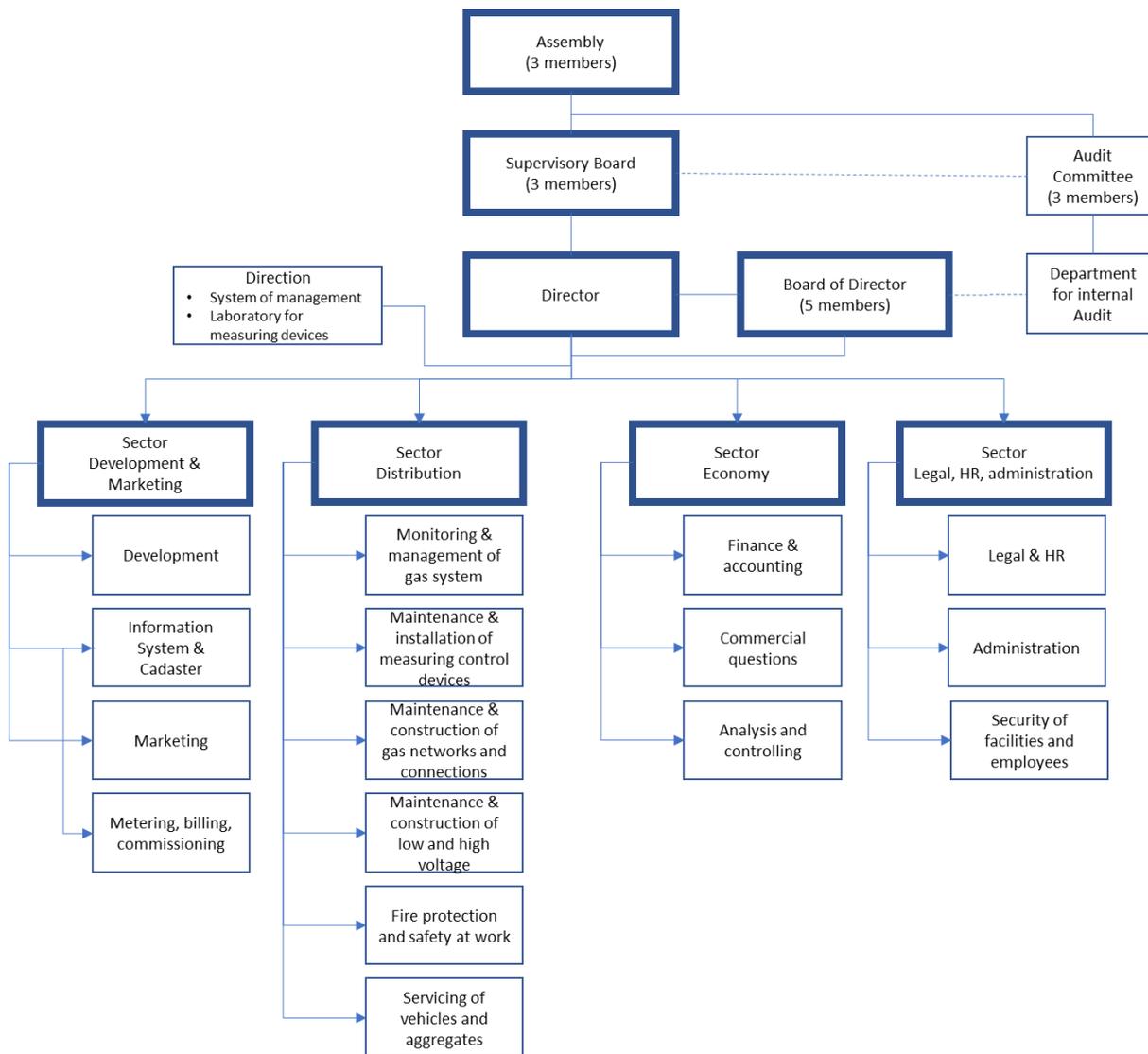


Figure 2: Organizational scheme of Sarajevogas d.o.o.³

Sarajevo-gas a.d. Istočno Sarajevo has about 27 employees and delivers an annual consumption of natural gas of about 3.3 mcm/y. It is organized in the following units:

- Assembly
- Internal audit
- Steering committee
- Executive Board / Directors
- Technical services
- Department for development and engineering
- Department for natural gas transmission

³ Source: Sarajevogas d.o.o. Sarajevo

- Department for distribution
- Economic and financial services
- Legal, personnel and general affairs

Important positions with regards to gas distribution are:

- a) The technical manager who is responsible for the design, construction, operation and maintenance of a gas supply facility. A technical manager must have the authority to decide on his own on issues that are relevant for the safety of the network.

A technical manager must be a graduate engineer of a relevant technical profession and needs to have the expertise necessary for the construction and/or operation of gas supply devices. This knowledge is acquired, by the completion of education at a high technical school, university or specialized school.

A technical manager must have at least five years of qualified professional experience in a responsible position in a company engaged in gas supply or a comparable business.

The technical manager must have, for his / her function, necessary knowledge of workers' protection, health and safety regulations, as well as technical rules G and GW (translation of DVGW) which must be followed during design, construction, operation and maintenance of gas supply facilities.

- b) Technical expert who is responsible for the implementation, design, construction, operation and maintenance of a gas supply facility. Technical experts with regards to gas distribution are engineers, technicians, and professional workers.

The technical expert must have knowledge and experience necessary for the execution of professional tasks and knowledge of workers' protection, health and safety regulations, as well as technical rules G and GW (translation of DVGW). A technical expert must be able to evaluate and execute tasks for which (s)he is responsible and to identify possible dangers based on experience and knowledge, also in the area of workers' protection regulations.

Outsourced employees, who are employed under the relevant legal regulation, must meet the same qualification requirements that are assigned to their own staff to perform this activity. Companies engaged in gas supply are obliged and authorized to issue orders, especially those relating to occupational safety and health and safety regulations.

According to the experience from other companies in the region, it is recommended for small companies (e.g., companies which are in the process of starting its business and developing the gas distribution network), to operate with a smaller number of own employees (at first), focusing on those areas necessary to fulfill the legal obligations from the technical rules mentioned above. Services related to gas metering, billing, construction, mechanical work, design of interior installations, installation, accounting, IT, legal, marketing and public relation can in general be outsourced and procured by external third parties.

At the very beginning the following positions with the following skill sets should be employed: employees with university degree (in engineering and in management, finance or economics); employees with high school education (technical and economics/finance affiliation), highly skilled workers (IT/metering/billing, distribution/maintenance, finance/commercial/accounting, legal/HR), skilled workers (maintenance and administration) and low skilled workers (maintenance). Depending on the specifics of the gas distribution network this may amount to a total of 12 employees (with 2 employees with each of the mentioned skill sets, except for highly skilled workers for which 4 individuals may be hired).

2.3 Required tools and equipment (e.g., hand tools, gas detectors, measuring and special tool, cars and trucks)

The required tools and equipment for conducting distribution services are defined in the technical rules G 1000 and GW 1200 - Organization of the technical distribution sector (Organizacija tehničkog sektora distributera). These documents are not publicly available free of charge, but a payment has to be made to get them. It is recommended that a new distribution company buys these rules and organizes its business in line with it.

Among others, these rules define requirements for the use of tools and equipment used for gas distribution on the following areas:

- Legal basis and terms
- internal organizational
- external organizational
- personnel, economic and technical preconditions in order to ensure safe and economical use of natural gas
- qualification and organization of the technical units and staff
- compliance with relevant regulations
- organization of emergency services (organizational structure, personnel and equipment) and procedures.

In doing so, also the following technical rules shall be applied for gas distribution:

- G 110 (Regional edition VI/2008): Devices for gas detection
- G 465-4 (2012 FBiH): Devices for leakage detection and measuring natural gas concentration during testing gas plants
- G 468-2 (Regional edition XII 2011): Person in charge of gas detection
- G 501 (Regional edition XI/2015): Procedure for remote gas detection from air

In case of a failure or damage of gas distribution network assets or an unplanned interruption of the gas distribution system, vehicles must be available with all necessary tools to react immediately to the interruption. The necessary number of vehicles depends on the size and structure of the gas distribution area. In general, based on experience from distribution companies in neighboring countries, it can be recommended that each gas DSO possesses at least two to three cars, three gas detectors and three additional gas detectors as backup. All other necessary equipment and tools are defined in the technical rules mentioned above.

2.4 Definition of operational procedures (for monitoring the system, regular and special maintenance, gas metering and billing)

A gas network operator should define its operational procedures and in particular prescribe the rules for solving operational issues/troubles as well as for re-establishing the operation of the gas distribution

network. The gas network operator should compile instructions for operation which specifies which measures should be taken in cases of deviation from pre-defined standards for operation. This report should be evaluated and should define in particular:

- the cause of a deviation,
- corrective/preventive measures to be taken, and
- how the correction/preventive measures should be conducted and monitored.

According to the Regulation on Natural Gas Supply of the Sarajevo Canton (Official Gazette of the Sarajevo Canton, No. 22/16), Article 25, the DSO is obliged to perform periodic inspection, control and maintenance of the gas distribution system of the Canton Sarajevo in order to:

- have reliable, safe and efficient natural gas distribution,
- prolong life of the gas distribution system of Canton Sarajevo,
- reduce using costs of the gas distribution system of Canton Sarajevo,
- prevent damage, fire and explosions, with the participation of competent authorities and professional institutions in Canton Sarajevo.

Article 26 defines that periodic inspection, control and maintenance shall be carried out according to the methodology defined in DSO's internal act, which is aligned with the applicable legislation and technical regulations about maintenance of the gas distribution system.

In addition, this Regulation also defines

- the customer's obligation during control and maintenance,
- the cases and procedures for the denial of access to the gas distribution network,
- requirements for third parties conducting construction work near the gas distribution system,
- the reporting of the disappearance, damage or interference at the gas meter and equipment,
- the procedures for maintenance and use of internal gas installations, reconstruction of internal gas installations, inspection of internal gas installations, and access to gas installations.

Rules for the operation of the distribution system of Sarajevo-gas a.d. Istočno Sarajevo defines in Art 15 that ODS is responsible for maintenance of distribution system in the way that:

- all activities taken in that respect cause as little of gas supply interruptions as possible,
- plan for regular maintenance for the next year is prepared by DSO by the end of the current year and published on DSO web site.

From the health and safety point of view in Art 16 is prescribed that DSO should:

- organize fire and hazardous protection activities,
- provide and organize emergency services,
- perform leak detection control of the user's internal installation after any works on user's installations are performed.

Article 17 prescribes that DSO should define measures and activities for the supervision, control and prevention of unauthorized third party's work in the protective corridor of the distribution pipelines.

The following technical rules shall be followed when operating gas distribution networks:

G 465-3 (2011 FBiH): Assessment of gas leakage on underground and above-ground gas pipelines

G 1200 (2012 FBiH): Basic principles and organization of emergency services for gas companies

G 1001 (Regional edition XI/2017): Security of gas supply; Risk management of gas infrastructure in normal operation

G 1002 (Regional edition XI/2017): Security of gas supply; Risk management of gas infrastructure in crisis

The Ordinance on conditions for undisturbed and safe natural gas distribution through a gas distribution system pressure up to 16 bar (Official Gazette of the Sarajevo Canton, 40/17), which are set according to the Technical Rule GW 1200, can be taken as an example for a regulation, which can be used for defining operational procedures:

Article 130 obliges the gas DSO to provide and organize:

- at least one point of contact/help desk at which users can report problems/issues,
- a duty team in charge of solving problems/issues in the operation of the gas distribution network,
- regular monitoring of the most important parameters on the gas system (flow, pressure, temperature and other).

In addition, Articles 131 to 137 of the same ordinance define how DSO should organize the engagement of external companies for the purpose of eliminating interference on DSO network, what properties should telemetric data acquisition system have, which parameters of pressure regulating/metering stations should be acquired and how to transmit these information and data over the telecommunication network.

According to Article 89 the use, observing and maintenance of distribution pipelines and its components must be done in accordance with the standards of BAS EN 12007-1 to 5 and the technical rules G 466-1, G 465-1, G 465-2, G 465-3 and GW 315. Furthermore, when civil works are done for the purpose of maintaining a distribution pipeline or when other construction work is conducted near the distribution pipeline, protection measures of the distribution pipeline defined in Technical Rule GW 315 should be performed.

Article 119 defines that the maintenance of pressure regulating stations and of metering stations can be conducted by the distribution company with own staff or outsourced to an external professional company that fulfills the personnel and material requirements of Technical Rule G 493-2.

Articles 120 to 123 define:

- measures for the maintenance of gas facilities,
- Authorized persons for the implementation of Maintenance Measures G495
- Removal of the weeds/vegetation on the gas pipeline corridor
- Deadlines for the implementation of Maintenance Measures G 495.

The following technical rules shall be followed for gas distribution:

- G 465-3 (2011 FBiH): Maintenance of gas pipelines with operating pressure up to 5 bar
- G 466-1 (2009 FBiH): Maintenance of steel gas pipelines for operating pressure above 5 bar
- G 492 (2010 FBiH): Design, production, assembly, testing, commissioning, operation and maintenance of gas measuring devices for operating pressure up to 100 bar

- G 493-2 (2011 FBiH): Qualification criteria for companies responsible for the maintenance of gas pressure regulating devices and gas metering in gas installations
- G 495 (2009 FBiH): Maintenance of gas installations

The Ordinance on Metering Conditions for Gas Flow Meters / Volume Measures (National Gazette of BiH, 26/18) prescribes metering and technical conditions which gas meters, with or without devices for volume conversion (hereinafter referred to as "gas meters"), need to fulfill, the procedures to be applied for the verification of the condition, labeling, the conformity assessment method and the procedures and for the control of gas meters.

Similar provisions apply for volume conversion devices (Ordinance on Metering Conditions for Devices for Gas Volume Conversion; National Gazette of BiH, 26/18). This Ordinance applies to devices, defined below, for gas volume conversion which are used for gas volume conversion for households, small businesses and small industry. This Ordinance applies to three types of conversions:

- Conversion as an exclusive temperature function (T conversion),
- Conversion as a function of pressure and temperature with constant compression factor (PT conversion),
- Conversion as a function of pressure and temperature at which the compression factor (PTZ conversion) is taken into account.

In addition, it is recommendable to fulfill requirements from G 687 (Regional Edition XII / 2011), which defines minimum technical requirements for gas measurements.

Regulation on Natural Gas Supply of the Sarajevo Canton (Official Gazette of the Sarajevo Canton, No. 22/16), can be used for setting internal rules regarding gas delivery and gas quality definition, the definition of the metering point and the procedures for meter reading, settlement and payment. This includes the following provisions:

Article 35 stipulates that measurement and takeover of delivered natural gas between the supplier and the distributor takes place at the main metering and regulating stations. Determination of the delivered (put into the system) and withdrawn (taken from the system) natural gas quantities must be done in accordance with the Regulation on Organization and Regulation of the Gas Economy Sector in the Federation of Bosnia and Herzegovina.

Article 36 defines that the correct measuring device must be installed at the natural gas delivery place, which must meet the requirements defined in the Metering Law of Bosnia and Herzegovina. Delivered and withdrawn natural gas quantities shall be defined in accordance with the contract on natural gas supply.

The gas distribution network operator is responsible for the control and maintenance of the measuring devices and of related equipment in accordance with the legal regulations and the professional rules (Article 39). The gas distribution company shall furthermore ensure the natural gas measurement at all points of natural gas supply of the gas distribution system (Article 42).

The natural gas delivered at the metering point is measured through the metering devices (Article 43). The distribution network operator determines for each delivery point the technical characteristics of the measuring devices and the associated equipment in accordance with the applicable regulations and standards.

After installation of measuring devices and associated equipment, the distribution company is obliged to seal the connecting elements at the measuring point to prevent unauthorized actions (Article 44). The seal can only be removed by a licensed worker.

At metering points with a pressure of above 100 mbar, quantities of natural gas shall be measured by a measuring device which has a volume corrector by pressure and temperature (Article 45). At metering points with a pressure above 23 mbar but lower or equal to 100 mbar, gas quantities shall be corrected by the equation specified in Article 55 of this Regulation. At metering points with a pressure below or equal to 23 mbar, it is considered that this is the standard gas condition so no correction is to be applied. At a metering point that is exposed to higher temperature changes, the amount of gas is measured by a measuring device which has a volume corrector or a temperature compensator. In case the gas distribution network operator detects that the gas flow measurement works properly while the volume corrector does not, the distribution network operator shall, for the purposes of defining the correct natural gas volume, convert data from the meter reading to standard conditions according to the equation defined in Article 55 of this Regulation.

Where the use of remote data transmission equipment is foreseen, the criteria for selecting the remote data transmission system as well as the kind and type of device shall be determined by the distribution network operator (Article 46).

The methods for determining the delivered and withdrawn quantities of natural gas, as well as the billing shall be specified by the contract on natural gas supply (Article 50). The distribution network operator is obliged periodically to read the gas meter. Measured natural gas quantities are the basis for calculating and invoicing delivered and withdrawn gas quantities.

Article 51 defines that distribution network operator shall organize a consumer's gas meter reading. Meter reading can be conducted:

- directly from measuring devices,
- indirectly with a device for remote reading.

When the natural gas price is going to be changed, the distribution network operator is obligated to do the meter reading of each customer.

Article 52 defines that the meter reading has to be conducted by a person authorized by the distribution network operator and that this person is obliged, at the request of the customer, to show his / her official ID or authorization.

In case the authorized person is not able to read a gas meter at the customer place, the customer is obliged to make a meter reading himself and deliver it to the distribution network operator two days after the authorized persons' notice. Also, the distribution network operator can stop the delivery of gas in case he is not able to read the gas meter.

The calculation and invoicing of the delivered and withdrawn gas quantities shall be done based on gas meter readings, as well as the approved gas sales price (Article 54). The costs of maintaining the measuring devices with the related equipment are to be shown as A special item on the bill.

The conversion of gas quantity from the working to the standard state shall be done according to the following equation (Article 55):

$$V_s = V_B \cdot Z$$

$$Z = \frac{T_s}{T} \cdot \frac{p_{atm} + p_e - \phi \cdot p_v}{p_s} \cdot \frac{1}{k}$$

Where:

V_s – natural gas volume at standard conditions, Sm^3
 V_B – natural gas volume at actual conditions, or natural gas volume without correction, m^3
 Z – correction factor
 T – natural gas temperature at actual conditions, K, $T = T_n + t$
 T_n – natural gas temperature at normal conditions, $T_n = 273,15 \text{ K (0}^\circ\text{C)}$
 t – natural gas temperature at actual conditions, $^\circ\text{C}$
 T_s – natural gas temperature at standard conditions, $T_s = 288,15 \text{ K (15}^\circ\text{C)}$
 ϕ – relative humidity of natural gas expressed in decimal number
 p_{atm} – atmospheric air pressure, mbar
 p_e – effective air pressure at actual conditions, mbar
 p_s – gas pressure standard conditions, $p_s = 1013,25 \text{ mbar}$
 p_v – water vapor saturation pressure, mbar
 k – compressibility coefficient, $k=1$ at $p_e \leq 1000 \text{ mbar}$

Article 56 defines that, when determining the delivered gas quantity, the measured gas quantity is corrected for a higher or lower heating value than the reference value of the natural gas determined under the standard conditions. The reference lower heating value of natural gas is determined by the competent authority. The volume of natural gas at standard gas condition is calculated on the billing volume using the following equation:

$$V_o = V_s \cdot \frac{H_d}{H_{dr}}$$

Where:

V_o – billing volume of natural gas, Sm^3
 V_s – natural gas volume at standard conditions, Sm^3
 H_d – net calorific value of natural gas defined for billing period, kJ/ Sm^3
 H_{dr} – referent net calorific value of natural gas, kJ/ Sm^3
 H_d/H_{dr} – coefficient of calorific value

When a distribution network operator, either by itself or after receiving a report, determines that the measuring device is not working properly for defining the consumed volume in the observed accounting period, except in case of unauthorized consumption, the average consumption from the previous period or the installed power of customers' gas appliances should be used for the determination of consumption (Article 57).

A correction of the invoice has to be done in the following accounting/billing period, if the mistake is related to incorrect meter reading (Article 58). The gas distribution network operator is entitled to get a compensation for the delivered natural gas quantities according to the determined distribution price for each tariff category (Article 59). Customers will get an invoice which specifies the natural gas selling price and all other points defined by relevant legislation (Article 60). The customer may partially or totally object to the invoice in writing within 8 days after the receipt of the invoice (Article 61). The customer is obliged to pay the indisputable part of the invoice within the agreed time.

If the customer does not make a payment within the agreed period, the distribution network operator is obliged to do the following (Article 62):

- stop natural gas delivery after the expiration of the notice period,
- initiate a regular procedure for payment in accordance with law.

In addition to all mentioned above, also the following technical rules for billing should be applied:

- G 685 (Regional edition II/2013): Gas billing
- DVGW G 685-B3: Gas billing, handling differences in gas meter reading, the determination of the amount of energy and of energy heating values, the determination of replacement values in case of missing or incorrect data, and the set-up of an account and billing.

2.5 DSO licensing

Federation of BiH⁴

According to the Ordinance on the organization and regulation of the gas industry sector (Official Gazette of FBiH, 83/07), natural gas distribution is carried out as an energy activity (Art. 7), provided that the company is licensed to carry out energy activities (Art 6. (1)). Furthermore (Art. 6 (2)), gas distribution systems may only be constructed and operated by energy entities under the conditions prescribed by the Construction Act. This includes the guarantee of technical safety by consistent application of technical regulations and regulations for the design, construction, commissioning and maintenance of gas systems, as well as the application of special technical and safety requirements in the field of environmental protection, prescribed by a set of environmental laws and subordinate regulations.

According to Art. 13, the distribution system operator needs to hold a concession for gas distribution or a concession for the construction of the gas distribution system (in addition to a license to carry out gas distribution activities).

Since a regulatory authority in charge of gas activities has not yet been established in the Federation of Bosnia and Herzegovina, the Ministry⁵ is responsible for issuing licenses for carrying out energy activities (Art. 9 of above mentioned Ordinance).

Republic Srpska⁶

According to the Gas Law (Official Gazette of the Republic Srpska, 22/18) a distribution system operator is defined as an energy entity performing the activity of distribution and management of the natural gas distribution system (Art. 3 (24)).

The gas distribution system operator performs the activity under the terms of a license issued by the Regulatory Commission of the Republika Srpska, in accordance with this Law and the regulations issued on the basis of this Law (Art. 69 (6)).

The conditions for issuing a license for gas distribution and the management of the natural gas distribution system, which are defined in detail in Art. 10 (1), require in particular that the applicant:

⁴ A detailed description on the current licensing procedures as well as of the organization of DSO and TSO activities is provided in two separate reports on licensing and system development delivered by DNV GL as part of the EIA project for Bosnia and Herzegovina funded by USAID.

⁵ In this case Federal Ministry of Energy, Mining and Industry

⁶ A detailed description on the current licensing procedures as well as of the organization of DSO and TSO activities is provided in two separate reports on licensing and system development delivered by DNV GL as part of the EIA project for Bosnia and Herzegovina funded by USAID.

- is registered for performing the energy activity for which the license shall be issued,
- meets the technical conditions for carrying out the activity and that objects and devices, installations or facilities which it manages and are necessary to carry out energy activities, meet the conditions and requirements, to be eligible for use as well as to meet the requests and requirements established by technical regulations, energy efficiency regulations, fire and explosion protection and environmental protection regulations,
- meets the prescribed criteria relating to professional qualifications of employees for the performance of technical management, handling and maintenance of energy facilities, appliances and installations in the natural gas sector or having concluded contracts with legal or natural persons for the performance of these activities and meeting the requirements of professional qualification⁷,
- possess evidence of the legal basis to use energy facilities in the natural gas sector in which the activity is carried out,
- meets the conditions related to tax compliance,
- meets the financial conditions, meaning that he has the financial resources necessary for carrying out the activity or proof that he can provide these funds,
- has no license been revoked for carrying out any activity in the natural gas sector in the previous five years from the date of the submission of the request, nor has it been imposed a measure prohibiting the carrying out of an economic activity,
- provides a proof that the members of the management or responsible persons are not convicted of criminal offenses or have not been granted a protective measure of prohibition of performing activities or duties related to the activity for which the permit is issued,
- adopts measures necessary to ensure the quality of the services prescribed by the Law, and
- meets other criteria necessary to carry out the appropriate activity in the natural gas sector in accordance with the Law, other laws and regulations regulating the issuance of a license to carry out activities in the natural gas sector.

According to Art. 10 (5) the Regulatory Commission may refuse the application for a license only on the basis of the provisions of this Law and the regulations issued on the basis of it. The Regulatory Commission furthermore submits decisions to reject an application for a license to the Energy Community Secretariat for information purposes (Art. 10 (6)).

A license for the operation and management of a natural gas distribution system is issued for the period of 15 up to 30 years (Art 11 (1)).

The following documents are to be provided together with the application for issuing a license for performing activities in the natural gas sector:

- valid decision on enrolment in a court or other appropriate register, with attachments,

⁷ Professional qualification of employees referred to in Art 10 (1), item 3) of the Law for conducting technical management, operation and maintenance of energy plants in the natural gas sector shall be checked by completion of an according professional exam (Art 18 (1)). The minister in charge of the energy sector issues an ordinance which prescribes the tasks for which a professional exam is required, criteria, the conditions and manner of conducting professional examination, the program of professional examination, the composition and manner of the commission, performing administrative and technical tasks related to taking the professional exam, content and form of attestation of the passed professional examination and which requires that a register of persons who have passed the examination is kept (Art 18 (2)).

- identification number and unique identification number (JIB) of the applicant,
- the founding act of a company with accompanying contracts or a statute,
- organizational structure of the applicant (organizational scheme), systematization of jobs, data on the number of employees and their professional qualifications (including information on passed professional examinations required for the performance of the activity and the type of work contract) and the applicant's statement that he has professionally qualified personnel for performing the required activity or contracts concluded with other legal or natural persons having professional competence to perform energy activities,
- statement that it owns facilities, installations and equipment that it can use, put into operation for the performance of energy activity or concluded contracts with other legal or natural persons having appropriate technical qualification,
- annual and three-year business plans of the applicant,
- contracts concluded with participants in the natural gas market,
- a set of financial statements for the previous three years, which includes: financial position statement (balance sheet), statement of the total result in the period (income statement), statement of cash flows, statement of changes in equity, notes to the financial report and report of an independent auditor or an initial financial position report for newly-formed entities,
- the statement of the applicant and the certificate of commercial banks that the applicant has sufficient funds, or that he has the possibility of credit indebtedness with the bank or the possibility of obtaining bank guarantees for the undisturbed performance of activities in accordance with the development plans,
- the statement of the applicant and the confirmation by the commercial banks of all open accounts of the applicant and their status (eventual blockages and volume of traffic) in the last month before the date of filing the request,
- loan agreements (debts, borrowings) with a repayment plan, if the performance of the energy activity is financed through a loan,
- statement of intent of introduction or plan and program of introduction of a quality management system (standard ISO 9001) into its business system, i.e., statement on the introduced or a copy of the certificate on the introduced,
- the certificate of the competent authority that for the applicant or his legal representative no measure of banning the performance, economic activity or duty for which the license is required is in force,
- the conviction of the competent court that the claimant is not conducting a bankruptcy or liquidation proceeding, and
- proof of payment of one-time regulatory fees.

Together with the application for issuing a license for performing the activity of gas distribution and the management of the natural gas distribution system, the following documents are obligatory to be enclosed:

- geographical map of the area on which the activity of the natural gas sector is performed / planned with a schematic representation of the gas system with the surroundings,

- the inventory of facilities, plants, equipment and devices with technical parameters and with the register of fixed assets from the accounting records that are necessary for carrying out the activity, containing the necessary data on the date of acquisition, the date of putting them into use, the purchase value, value adjustments, the annual depreciation cost, subsequent estimates, impairment, fair value, revaluation reserve, degree of use with depreciation policy and nomenclature of fixed assets for the calculation of depreciation,
- statement / certificate of insurance of facilities and equipment for performing activities,
- use permits according to laws in the field of spatial planning and construction,
- ecological permit obtained in accordance with regulations,
- a concession contract in accordance with the regulations on the granting of a concession or a valid legal act on entrusting the performance of an energy activity as an activity of general interest,
- description of the system for measuring and monitoring the quality of gas and the quality of delivery,
- plans and reports on maintenance of the distribution system in the last three years,
- records and solutions of the competent inspection bodies and a review of the activities carried out on the basis of the decision of the competent authority regarding the technical correctness of the system (occupational safety, fire and explosion protection and environmental protection),
- valid operating rules for the gas pipeline system, and
- user data (number and category) whose facilities are connected or have the possibility of connecting to the natural gas distribution system.

3 DSO NETWORK DEVELOPMENT

The starting point for the development of the future gas distribution system should be a gasification (feasibility) study conducted for the considered area, developed by experts and the companies with necessary know-how. Such study should include:

- an analysis of the potential natural gas market in the area for which the development of a gas distribution network is considered (taking into account the current and possible future alternatives to natural gas (such as oil, coal, wood, electricity, district heating, heat pumps, solar thermal energy),
- short-term and long-term demand forecasts by sectors of consumption,
- defining the optimal distribution grid (pipeline routes) for the supply of certain parts of the city,
- defining the necessary infrastructure (gas pipelines and gas pipeline facilities) and the proposal for the development of the distribution grid in the area under consideration,
- the implementation schedule i.e., the dynamics of reaching the planned capacities,
- total investment costs and the cost structure (from the design phase up to the final commissioning).

The gasification (feasibility) study should evaluate the properties of the proposed concept of gas distribution network development in the considered area. In addition, such study should also include an

assessment of environmental regulations and an economic-financial analysis including a sensitivity analysis.

3.1 Definition of the potential volume of distributed gas (studies on future gas consumption in the distribution region, conduction of a survey)

Estimating current and future gas consumption of individual consumers or groups of consumers should be the basis for the determination of the required network capacity. In addition, it is necessary to know (presume) any plans for spatial expansion, increase in density of consumption, or redesign of the system for other conditions.

The procedure outlined below is illustrated by an example from an existing gasification feasibility study for Zenica.⁸

For the planning of the gas network the following documents can be used:

- the spatial planning document of the territorial unit (e.g. municipalities),
- the urban development plan (or the proposal of the urban development plan),
- the geodetic basis for the area of the municipality, scale 1: 25000 (topographic maps) and 1: 2500 (cadaster maps) (Cantonal Bureau for Urban Planning and Physical Planning and Authority for Property-Legal, Geodetic Affairs and Real Estate Cadaster),
- development strategy of the respective territorial area (municipalities),
- data on district heating systems (if there is a district heating system), and/or
- data on consumption of large energy consumers.

The analysis of potential natural gas consumption in the housing sector for the considered area can be estimated in two ways.

The first option is to identify the existing number of housing units (individual houses in urban areas and rural areas and collective buildings (flats) in urban areas) and the expected urbanization, and to determine the expected average natural gas consumption per housing unit (heating, cooking and hot water preparation), by which, with the anticipated dynamics of the transition of households to natural gas, the dynamics of natural gas consumption in the housing sector can be predicted.

The second option is to produce an energy balance of the considered area, which also determines the existing structure of the alternative (competitive) energy sources used to meet the energy needs (heating, cooking and hot water preparation). The dynamics of transition to natural gas can be forecasted, considering the competitiveness of natural gas in comparison to energy sources currently in use (e.g., competitiveness with respect to liquid fuels; for solid fuels also the comfort of the use of natural gas or the value of their own time spent required for the use of solid fuels should be taken into account).

Data necessary to determine the existing energy consumption and to estimate future energy needs, can be collected and processed by field research, surveys and questionnaires with industrial, commercial and public sector energy users (e.g. education institutions, health institutions, municipal administrative

⁸ Studija izvodljivosti gasifikacije Zenice – knjiga 1, IGT – Institut za gasnu tehnologiju, Sarajevo, January 2009.

institutions and authorities), the tourism sector (e.g., restaurants, hotels, motels) and with users in the collective and individual housing sector.

The criteria for calculating fuel consumption depend on the use of heat (heating, cooking or preparation of hot water).

The criterion for the calculation of fuel consumption for heating purposes are the specific heat requirements (expressed in W/m²) for:

- individual facilities (family houses) in urban areas and rural areas,
- collective facilities (dwellings) in urban settlements,
- facilities of public institutions and the private service sector (administrative facilities, health and education institutions, catering and tourist facilities ...), and
- industrial facilities for which no energy consumption data is available (or industrial space areas currently empty for which the future technological use is unknown, but which are taken into account for the planned gas consumption).

For existing boiler installations used only for heating purposes or preparation of hot water, annual consumption data can be taken from the database obtained from users or boiler owners (such as installed power, power input, consumed energy, etc.).

For new boilers/gas appliances to be used for heating purposes, for which there is no annual consumption data, the annual consumption is typically calculated on a degree-days basis as one of the elements in the calculation equation.

The number of degree-days is calculated by the multiplication of the number of days with heating and the temperature difference between the agreed mean indoor air temperature (usually 18 °C is accepted, although 19, 20 or 22 °C is often used, depending on the space use) and the outside air temperature (where only those days in the year in which the air temperature is lower than 12 °C are included)⁹.

$$N_{DD} = \sum_{n=1}^h (18 - t_{AATH}) \times N_H$$

where:

- N_{DD} Number of degree-days [degree-days]
 t_{AATH} Average annual temperature in the heating period [°C]
 N_H Number of days with heating [days]

For the area for which a development of a gas distribution network is considered, data on the air temperature is also required as input to the analysis.

The required amount of hot water for various types of consumers can be determined by the average amount of hot water typically used per person per day (40l for family houses and flats, 70l-100l for

⁹ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003.

hospitals, 50l-80l for hotels)¹⁰. In the case of hospitals and hotels, data on the number of beds and litters per day and bed can also be used.

Calculation of annual requirements for natural gas for cooking in large kitchens in hospitals and hotels / motels can be determined by the number of beds and the number of meals per day and the specific consumption of gas per meal.

For the needs of hot water preparation in the housing sector, including needs for cooking, the ratio of total natural gas consumption to natural gas consumption for heating purposes is often applied.

Following the assessment of the annual gas consumption, the gas demand used in the residential sector (heating, hot water preparation and cooking) by month, and the gas demand used in the public sector (heating) by months can be calculated according to VDI 2067¹¹.

This method, though more demanding, also allows to determine the possible (expected) degree of replacement of existing fuels with natural gas according to its expected competitiveness compared to existing fuels.

The following describes the procedure proposed in the existing Zenica gasification feasibility study.¹²

The database for the energy balance (i.e., the structure of the existing energy consumption) is put together by the following methods: recording of potential gas consumers, statistical processing, and collection of relevant field data. All the above refers to the part of the territory for which the analysis is carried out which is not and will not be covered by the district heating system.

Data on individual housing facilities, can be obtained for the respective territory (municipalities), from statistical data put together by competent municipal services and extracted from planning documents (Spatial and Urban development plans). The energy balance of individual housing is based on the recording of the total number of individual housing facilities, a calculation of the heated surface and experience indicators for the required amount of heat energy needed for individual houses, hot water preparation and cooking.

Based on the data collected, it is possible to make an estimate of the share of energy sources used in the housing sector for heating, hot water preparation and cooking and to analyze the required energy in the housing sector, as the percentage of energy sources used to produce the necessary heat for heating, hot water preparation and cooking. The energy sources used for this purpose are electric energy for the preparation of hot water and cooking, and wood and coal, and partially also electric energy, for heating (of course, depending on the situation (current fuels of preference) in the considered territory, analysis can also include liquid fuels and LPG).

Based on the predicted degree of gasification (% of number of objects), an overview of the required energy in the individual housing sector is obtained, which from the aspect of consumption of energy sources would be substituted by natural gas.

The energy balance in the public and private services sector is based on

¹⁰ Source: Studija izvodljivosti gasifikacije Zenice – knjiga 1, IGT – Institut za gasnu tehnologiju, Sarajevo, Januar 2009.

¹¹ VDI 2067 "Economic efficiency of building services systems"

¹² Studija izvodljivosti gasifikacije Zenice – knjiga 1, IGT – Institut za gasnu tehnologiju, Sarajevo, January 2009.

- the recording of the total number of facilities in this sector (all the facilities surveyed for which data are obtained from the competent persons in these public institutions (education institutions, municipal / canton institutions, healthcare institutions) and tourist facilities (hotels, motels)),
- the calculation of the heated surface area of facilities, and
- experience indicators for the required amount of heat energy for heating, hot water preparation and cooking.

Industrial capacities that are not in operation, and only have information on the usable area of the floor space, are processed only from the point of view of natural gas consumption for space heating of industrial halls (W/m²).

For the industrial capacities, where there is no complete data on the installed power for the technology / heating (and where the installed power of the plant is not a reflection of planned energy needs), the calculation of planned natural gas needs can be expressed on the basis of energy / planned heat load requirements the users expressed in their planned consumption.

Finally, also the energy sources used for production of heat energy should be included in the analysis by adding data obtained for the centralized district heating system (if such a system exists).

On the basis of the analysis of heat energy consumption in the reference year, an assessment of the increase in the consumption of heat energy in all sectors (energy consumption foreseen for the substitution of existing fuels with natural gas) shall be carried out for the observed future period.

The starting point for projecting energy needs for the housing sector and the public sector is an estimate of the growth of the housing construction sector, based on an assessment of municipal urban planning offices. Residential housing growth projection (annual growth rate in %) is usually performed in multiple scenarios (high and low scenario). The starting point for projection of energy needs for the industry sector is the long-term projection of real GDP growth (average annual growth rate).

Based on the above mentioned, a percentage increase of projected energy needs in the housing, public, private services and industrial sector in the observed territory and in the observed future period can be determined, as well as the growth of energy consumption in the housing, public, private service and industrial sector, from the aspect of energy consumption (coal, wood, liquid fuels, electricity, LPG), in multiple scenarios of heat energy consumption (as a rule, the higher and lower energy balance scenarios).

The share of natural gas is forecasted according to the estimated percentage of replacement of existing fuels with natural gas for each consumer's category (where the criterion may be also the competitiveness of natural gas in relation to existing fuels).

3.2 DSO system planning (definition and decision on capacity, location, shape and main parts of network)

The basic piece of information for the technical planning or design of the gas distribution network is not the required energy, i.e., the total annual or monthly consumption, but the hourly consumption, which means that, together with the estimation of the total annual quantity (and the quantity by months, which determines the level of system utilization) it is necessary to determine the required capacity meaning the maximum expected hourly quantity (i.e., peak demand).

The following description is largely based on the existing feasibility study for the gasification of Zenica.¹³

Calculation of natural gas demand for technical purposes is obtained from the annual fuel consumption in boiler plants of such type of consumers and other related data (power installed, power input, energy consumption, etc.).

The number of working hours for each type of facility can be determined according to VDI 2067 for heating purposes, based on which the calculation of the energy (capacity) needs (hourly consumption of natural gas) for the public and private service sectors (schools, hospitals, hotels, health centers, institutions of municipal administration, etc.) can be made. The same norm also defines the expected number of working hours for heating in the year for family houses (single-family or multi-family).

Hourly gas consumption can be determined also by the type of household and gas appliances available on the market (according to the experience of the distribution companies) and the share of representative types of households in the total number of households expected to switch to natural gas.

For illustration purposes, an example of hourly gas consumption by household type is presented in the next table.

Table 1: Example of gas consumption by type of household – gas appliances available on the market (values observed by gas distribution network operators)¹⁴

Type of household	Type of gas appliances in the household	Number of appliances	Maximum consumption Sm ³ /h	Simultaneity factor (-)	Corrected consumption Sm ³ /h	Σ
A	Combined stove gas - electricity	1	0.53	0.14	0.08	1.82
	Combination of boiler for floor heating and hot water preparation 24 kW	1	2.56	0.68	1.74	
B	Combined stove gas - electricity	2	0.53	0.14	0..16	2.77
	Combination of boiler for floor heating and hot water preparation 18 kW	2	1.92	0.68	2.61	

¹³ Studija izvodljivosti gasifikacije Zenice – knjiga 1, IGT – Institut za gasnu tehnologiju, Sarajevo, January 2009.

¹⁴ Source: Studija izvodljivosti gasifikacije Zenice – knjiga 1, IGT – Institut za gasnu tehnologiju, Sarajevo, January 2009.

Type of household	Type of gas appliances in the household	Number of appliances	Maximum consumption Sm ³ /h	Simultaneity factor (-)	Corrected consumption Sm ³ /h	Σ
C	Combined stove gas - electricity	1	0.53	0.14	0.08	0.78
	Gas furnace for heating 8,0 kW	1	1.02	0.30	0.31	
	Gas furnace for heating 3,5 kW	1	0.43	0.30	0.39	
D	Combined stove gas - electricity	1	0.53	0.14	0.08	2.36
	Hot water boiler for central heating 30 kW	1	3.36	0.68	2.28	

When determining the total hourly gas consumption of the gas system, the simultaneity factor is of key importance. The maximum simultaneous consumption is not the sum of the maximum consumption of all consumers, or the sum of the maximum capacities of gas connections, but the hourly amount that derives from overlapping consumption of all consumers within a specific hour.

In general, the simultaneity factor is an empirical factor resulting from meteorological conditions and level of living standard, as well as from the number of consumers and their purpose of gas use. As a rule, it should be determined by each distribution network operator and it changes over time. For illustration purposes, we present a datasheet for the simultaneity factor in the table below. The simultaneity factor already drops significantly for small increases in the numbers of gas consumers in case of natural gas use for cooking and the preparation of hot water. In case of floor heating (i.e. central heating of one residential unit in the multi-floor buildg) the simultaneity factor only drops for large numbers of gas consumers. This leads to the conclusion that the gas consumption (Sm³/h) for floor heating may be one of the most influential factors for the dimensioning of the gas network.

Table 2: Simultaneity factor for a different number of consumers and different uses of natural gas - example¹⁵

Number of consumers	Cooking	Hot water preparation	Floor heating
1	1.00	1.00	1.00
5	0.70	0.50	0.92

¹⁵ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

10	0.57	0.43	0.88
25	0.40	0.37	0.84
50	0.29	0.34	0.80
75	0.24	0.34	0.78
100	0.20	0.33	0.76
200	0.15	0.32	0.73
500	0.14	0.31	0.69
1000	0.14	0.30	0.68

As a basis for planning, it is necessary to review the spatial coverage of the territorial area (e.g., of the municipalities) for which gasification is planned (as already mentioned, usually the documentation of urban planning offices is used). Local communities of municipalities are divided into areas (according to the consumption of heat energy), and within them field surveys are made (via questionnaires) in order to look at the energy consumption (energy balance of the municipality) and view the need for natural gas (housing sector, i.e., individual housing, public sector, commercial and industrial sector). In the further analysis, areas are grouped according to the sections of the construction of the primary/main gas distribution network and the corresponding district pressure reduction stations.

The first step in the design of the pipeline plan is to determine the conditions of gas supply, i.e., the location of the main gas regulating station for the selected pressure level of that network segment.

It is often the case that the gas is transported directly from the transmission system through the regulating station to the primary distribution system. In many cases it is necessary to create a high-pressure system that transports gas to the regulating stations of different consumption centers. For very large systems, there may be a need for a high-pressure distribution network that operates at a pressure lower than the pressure of the transmission system but higher than the distribution system pressure (about 16 bar). It is generally desirable that the regulating stations of the transmission network and of the distribution system are as close as possible to larger consumers. The locations for these large consumers – currently and in the future – should generally be known to urban planning institutes.

When a location of a regulating station is determined, the next step is to select the pipeline route disposition/spatial layout, which connects all the consumption facilities. Thereafter, an analysis is carried out on the planned network plan (pipelines layout) to determine whether the capacity is sufficient to meet the forecasted gas consumption. Then the dimensions of the gas pipelines are accordingly increased or decreased, loops are added and closed until the desired optimum system is established. For larger systems, several dispositions/spatial layouts of gas pipeline network can be prepared with different locations of regulation stations, i.e., with different routes of distribution pipelines.

Sometimes gas consumption (load) for the area of gasification develops slowly, i.e., during 8 to 10 years or longer. In such cases, sometimes it is not economically justified to build a large system before consumption reaches a level which makes an expansion of network capacities necessary.

Although a number of alternative pipeline system solutions for the supply of a certain group of consumers can already be excluded based on their high associated costs, a choice needs to be made between the remaining solutions. The decision on the final network design to be constructed should be made based on a comparison of the costs and benefits associated with alternative pipeline layouts and the flexibility of

these alternative distribution network structures to meet future changes in gas demand (which can be both higher and lower). One indicator for the possible benefits, is the gas consumption per unit of length (m^3/km). A second indicator, sometimes used, is the amount of regulating pressure stations needed to maintain the desired minimum required pressure at each disposition/spatial layout of the gas pipeline. If the required pressure in the regulating station exceeds the available pressure, then the system performance is insufficient. Therefore, the requirements for pressure levels in supply points (RS – reduction stations) are largely used as indicators of system adequacy. Another indicator is an analysis of the pressure at the system nodes. A system in which most of the pressures at the nodes is close to the amount of pressure at the point of supply obviously has a greater spare capacity than a system in which most of the working pressures reach the minimum amount at the ending points of the system. An explanation of the node concept is provided in the following in order to clarify the concept of hydraulic calculation of the gas network.

All of the above indicators provide information on the comparative advantages of the various disposition/spatial layout plans for the considered system. Cost-effectiveness factors, such as the estimated construction, operation and maintenance costs and the expected lifespan of the system are significant when choosing the solutions to be applied (without compromising reliability and security of supply levels).

The shape of the network depends to a great extent on the size, shape and pressure levels of the distribution network area and the consumer density. The material for the distribution system and the number of regulating stations are determined by the gas distribution company on the basis of the current gas regulation, state of technology and own experience.

In principle, for any distribution network area with different consumption densities, different consumption levels, and various purposes of gas usage, it is generally possible to use five different types of network:

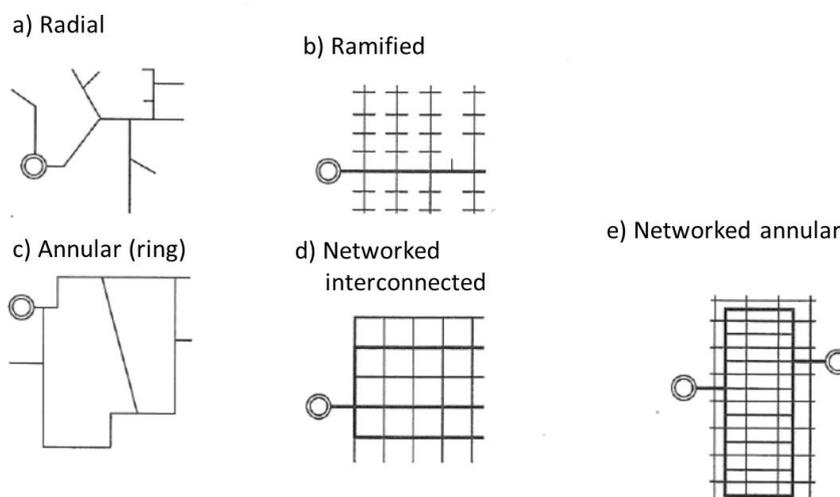


Figure 3: Different shapes of natural gas networks¹⁶

Each of the above shapes for a gas distribution network, has its advantages and disadvantages in terms of reliability of supply and cost-effectiveness of construction. Network shapes a), b) and c) are generally suitable for medium and high pressure gas distribution networks and will be rarely used for large areas. The network shapes d) and e) are generally applicable for gas network operated at different pressure

¹⁶ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

levels. They are used for large distribution systems with a high density of connections where some network segments are operated at low-pressure (up to 100 mbar) and others at medium or high pressure. In network shapes a) and b), each point at which gas end-users are connected is only supplied via a single pipeline, while in shapes c), d) and e) each end-users could be supplied via different routes or paths of the gas flow. The basic characteristics of these network shapes are summarized in the table below.

Table 3: Basic characteristics of network shape¹⁷

Type of network shape		Financial investment (costs)	Reliability of supply
a	radial	small	low
b	ramified	small	mid
c	annular (ring)	mid	mid to good
d	interconnected network	large	good

What shape fits best to a specific gas distribution network area, depends not only on the size of the distribution system and on the density of consumption, but also on the importance of the reliability of supply and various geographic obstacles (rivers, streams, bridges, railroads and roads). In many cases, several types of network shapes are used in large distribution systems. In dense urban areas (city center) d) and e) networks are typically used, while shapes a) b) and c) can be used in the suburbs. Consumers of higher connection capacity are normally connected to higher pressure networks, while small consumers (households, small services) connect to low or medium pressure networks. Thus, the number and ratio of such consumers are also a basis for the choice of the network shape.

It has been shown both in theory and practice that reliability of gas supply is best ensured for high, medium and low pressure networks by constructing the network in an annular shape. The construction of such a distribution system for every part of the network would be very expensive. It is therefore typically combined with various semi-rings and crosslinked loops.

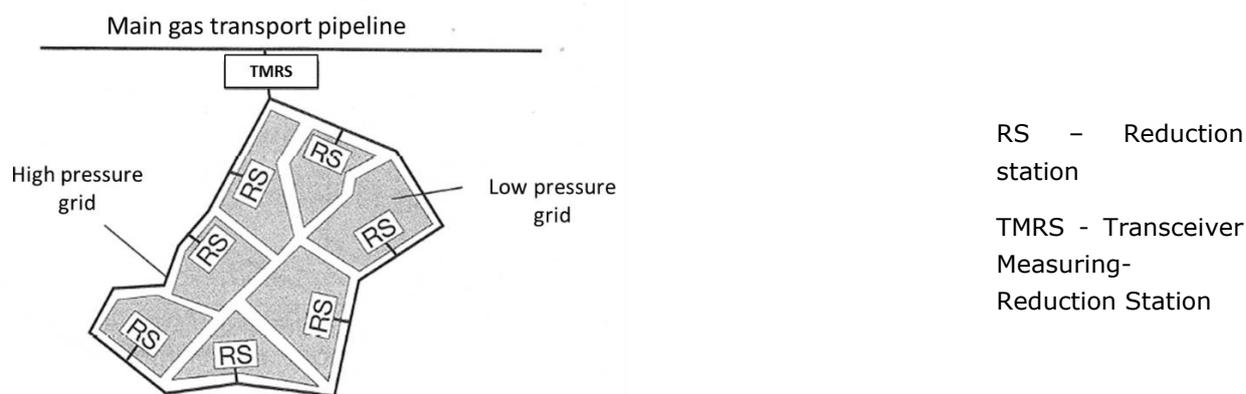


Figure 4: A high pressure annular network and its connection to the main transmission gas pipeline¹⁸

¹⁷ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

¹⁸ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

The high-pressure gas distribution pipeline exits from the transceiver measuring-reduction station, branches in two directions and forms a closed ring around the entire gas supply area. Reduction stations (RS) are connected to this high-pressure gas line, supplying a larger industrial consumer or a certain distribution area. Exit gas pressures from the reduction stations can be up to 100 mbar, 1 bar or 3 bar, depending on the further design of the system.

Another example of a high-pressure gas system is described further below. In this case the location of the high-pressure gas pipeline within the distribution system is determined by the location of the main gas transmission pipeline. Across the gas consumption area, a semi-ring gas pipeline is placed, which is supplied from both ends, at which transceiver measuring-reduction stations are situated, from the gas transmission network. For this example, it would result in excessive and unnecessary costs to build a high pressure gas distribution ring, as was shown in the previous example.

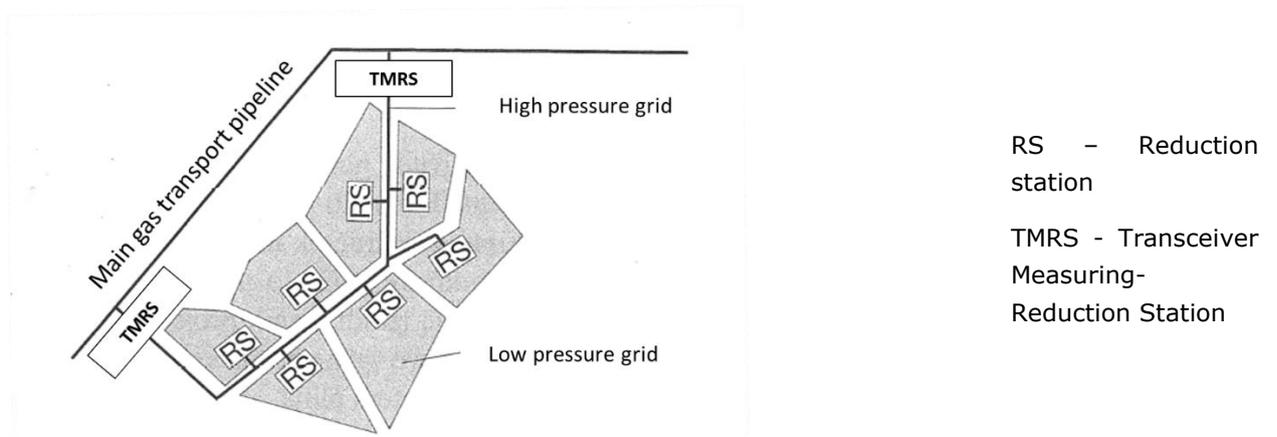
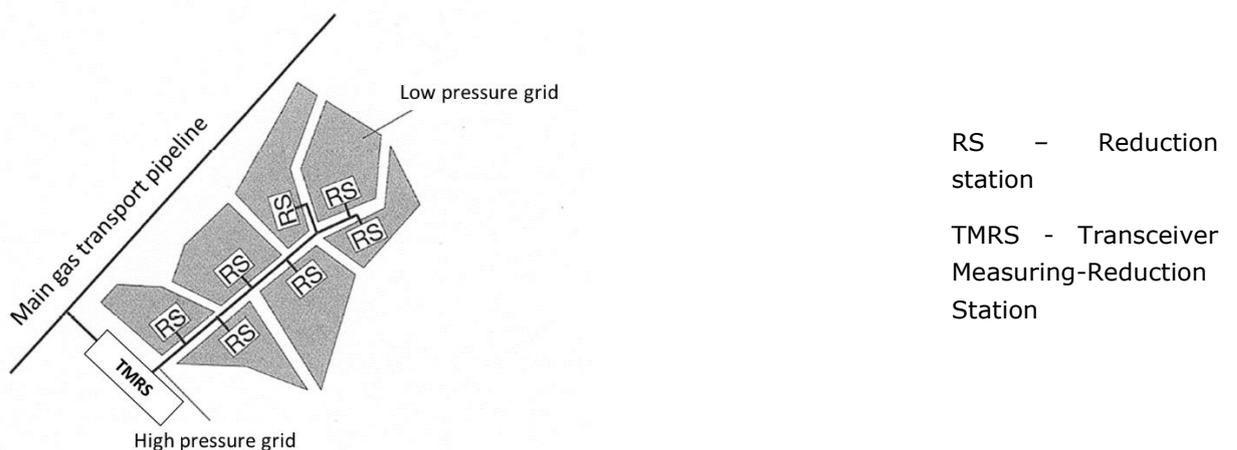


Figure 5: A high-pressure semi-ring network and its connection to the main gas transmission pipeline¹⁹

The following example shows a high-pressure radial shape in a settlement. In this case, it can be seen that the high-pressure, radial shape of the network is supplied from one direction, which does not provide a high level of reliability for the supply of consumers.



¹⁹ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

Figure 6: A high-pressure radial network in the distribution system and its connection to the main gas transmission pipeline²⁰

Of course, it should also be borne in mind that the allocation of transceiver measurement-reduction stations (i.e. the number of outputs from the transmission system) also depends on the transmission system development plans proposed by the transmission system operator.²¹

As a general rule, an annular (networked) distribution system describes a network structure where gas pipelines are placed in all the streets and well interconnected with all intersections to the supply system. Such networks are normally used for low pressure distribution systems with supply pressure up to 100 mbar. Because these networks provide alternative gas supply routes to the main gas (transmission) pipeline, they generally minimize the occurrence and the impact of a supply disruption.

Alternative options, as previously noted, are a radial network, with no closed loops, and a combination of both shapes (annular and radial), which is actually the most common structure in practice.

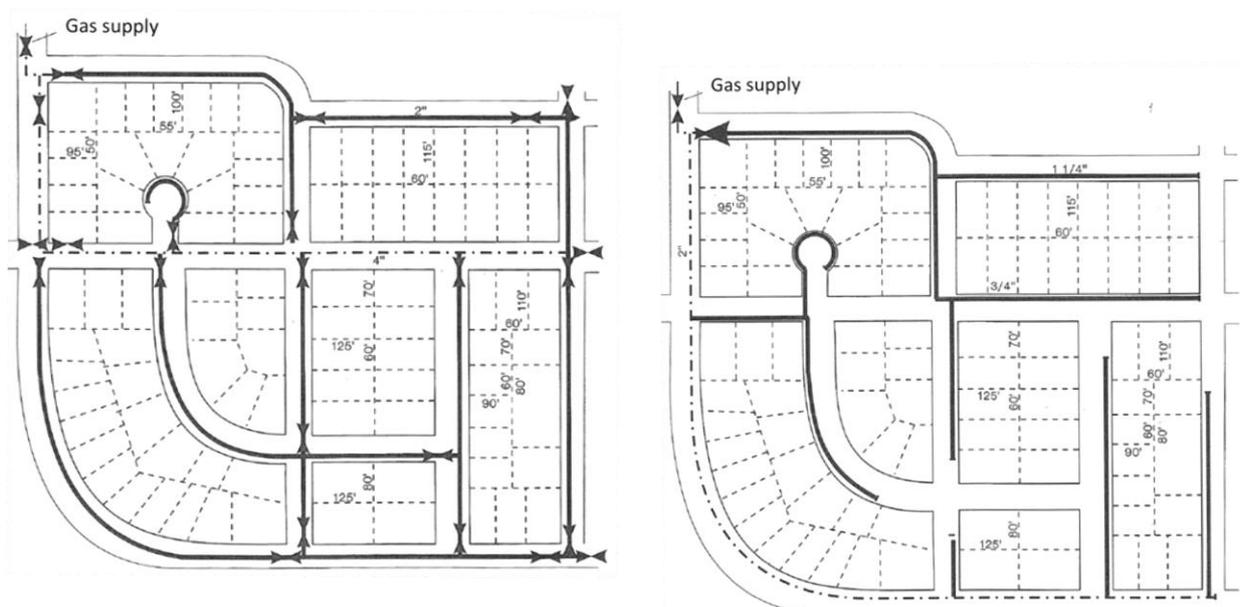


Figure 7: A fully interconnected (left) and radial (right) distribution system²²

²⁰ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

²¹ This example demonstrates the need for co-operation and co-ordination of all stakeholders in the process, each within the framework of its competences, which, in the example of the Federation of Bosnia and Herzegovina, also prescribes the Ordinance on Organization and Regulation of the Gas Industry (Official Gazette of the Federation of Bosnia and Herzegovina, 83/2007), (Art 9) The canton is responsible for the development of the distribution system in its area, and the cantonal ministry responsible for energy affairs participates in the preparation of physical planning documents at the cantonal level adopted by the Cantonal Assembly. The Federal ministry is responsible for planning the construction and additional capacities of the gas system and it is also issuing its opinion in the drafting of the physical planning documents issued by the Parliament of the Federation of Bosnia and Herzegovina. The Transport System Operator is obliged to draw up and make plans for the development, construction and modernization of the gas system in accordance with the provisions of the Ordinance and the applicable legal regulations. The development plans are made for a period of at least 3 years and must be approved by the competent ministry. The Distribution System Operator (Art 14) is obliged to produce and submit to the Ministry an annual report on the implementation of the system development plan.

For RS, according to Gas Law (Official Gazette of the Republika Srpska 22/18) it is prescribed that TSO should prepare Ten-Year Network Development Plan - TYNDP (Articles 47 (4) and 53 (1)), while DSO should prepare TYNDP (Article 75 (1)) harmonized with TSO's TYNDP. All plans should be in line with Strategy on Development of Energy Sector in RS, should be publicly discussed and finally approved by Energy Regulator.

²² Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

The construction costs of a radial system are typically lower than those of an annular system. When analyzing such networks, it is very important to strive to achieve an acceptable relationship between cost-effectiveness and reliability of supply.

The degree of use of the loops in the grid is determined by the type (purpose) of gas use. A continuous/reliable supply of gas is generally much more important for tall buildings with a large number of consumers and various institutions related to health or education (such hospitals, schools or kindergartens).

When both annular and radial shapes are applied for different parts of a gas distribution network, loops are generally used after reduction stations (center of supply), while radial shapes are generally used on the edges of the network.

The choice between the exclusively radial or annular shape, or a combination of these shapes, is not limited to the reliability of the supply itself. Networks may also ensure intermittent consumption while parts of the gas is redistributed to other distant parts. The radial shape of the network has lower possibilities for securing gas redistribution, even if the capacity of the gas transmission pipeline is increased, because this expansion of capacity is limited to network areas in close proximity to the main gas transmission pipeline. On the other hand, the fully interconnected system has the ability to meet the needs of new potential consumers, which could happen in all directions. It is even possible to "remodel" parts of the network to operated at higher pressure.

A radial network system may therefore in general be more suitable for static networks, while interconnected systems are a good foundation for further dynamic network development.

In addition to the location and shape of the basic elements of the gas network (closed or radial system), the position of the transceiver measuring and reduction stations (for which coordination is necessary with the transmission system development plans) also certain parameters related to planning the location of other gas system elements should be considered, which are further described in the following.

Connecting pipelines

Usually, separate connecting gas pipelines are installed for each consumer. They are generally following the shortest route from the existing gas distribution network (e.g., located in the closest street near by) to the building. In areas with high consumer density, the connection pipeline can follow a different route for two or more consumers. In such cases connection pipeline mark should be fixed on the building.

Selection and location of regulating stations

The selection of equipment, capacity and position of the regulating station greatly influences the safety and reliability of the part of the network that the gas station supplies. The type of regulator, the shape of the object and its placement affect the noise, but also the price of the object. It is much more convenient to extend the high-pressure system in the low-pressure grid and build a station rather than to carry out large reconstruction of the gas pipeline itself. It is very difficult to talk about the optimal choice of location for the reduction station because the networks are usually expanding so that the location optimum is closely related to the network structure at different points in time. Selected equipment of (one or more) pressure regulating lines, safety devices and the type of selected equipment greatly affect the safety of the operation and the reliability of the supply.

Pipeline layout

For a specific group of gas consumers there are theoretically many possible pipeline design plans that can provide the necessary supply to current and future consumers. However, there are a large number of

limitations and the application of basic system design logic can help to reduce the number of realistic alternatives to an acceptable level.

Some of the most important limitations are:

- the location of the regulating station for new gas distribution systems is significantly influenced by the existing layout of the transmission pipelines and the transceiver measuring-reduction stations,
- the available gas pressure from the existing infrastructure limits the working pressure level of the system, which is envisaged to be created,
- if there is already a partially installed pipeline infrastructure, it reduces the options for the layout and dimensions, and influences the decision on new gas pipelines and various reconstructions,
- the existence of public surfaces for the installation of the pipeline and the location of the regulatory stations limits their other potentially more favorable positioning,
- physical obstacles, such as rivers, streams, railways and motorways, also limit the possibility of their placement.

Sometimes gas pipelines are placed on both sides of wide streets to avoid laying long pipelines below the roads. The best location for gas pipeline is the green belt between the sidewalks and curbs, sidewalks and the boundaries of the parcel when it is on the sidewalk near the road paved.

According to the Rulebook on conditions for unobstructed and safe distribution of natural gas through a gas distribution system up to 16 bar²³ (Official Gazette of Sarajevo Canton, 40/17), it is necessary to consider the following provisions, when selecting the distribution pipeline route (Art. 4, requirements for the selection of the route):

- the distribution pipeline does not endanger the existing and planned facilities as well as the planned use of the land in accordance with the planning documents,
- the distribution pipeline is not planned near the trees, thus avoiding the endangerment of the natural environment and the possibility of damaging the gas pipeline by the growth of the roots, the rational use of the underground space and the construction surface, meeting the requirements regarding the technical requirements of other infrastructure facilities in accordance with special regulations,
- compliance with geotechnical requirements,
- the placement of the distribution pipeline into hollow spaces, for example in ductwork, in/on bridges or the like, is allowed only if the hollow spaces are sufficiently ventilated or if the gas pipes are placed in protective pipes ending outside hollow spaces,
- the placement of the distribution pipeline in underpasses and passageways, for example for pedestrian or truck transport, is permitted even without a protective pipe if there is sufficient natural ventilation.

Furthermore, if the construction of a distribution pipeline on privately owned land is technically and economically justified, the gas distributor on the distribution gas pipeline has to anticipate all the necessary preconditions for an unobstructed and safe gas distribution and to have access to the distribution pipeline

²³ As Stated in System Development Report - International Experience, Status Quo in Bosnia and Herzegovina, Analysis of Gaps and Recommendations there is no similar technical regulation for other DSOs in FBiH, while in RS some elements are present in Rules of operation of the natural gas distribution system adopted for Sarajevo-gas a.d. Istočno Sarajevo and Zvornik stan a.d. Zvornik.

in case of necessary intervention. In populated areas, the distribution gas pipeline is to be built in designated infrastructure corridors.

According to Art. 5 (Distances from the objects), the design for the construction of a distribution pipeline should ensure that the minimum horizontal distances of the underground distribution pipeline from residential buildings or facilities that are permanently or occasionally inhabited are 1 meter for gas pipelines of the pressure ≤ 5 bar or 3 meters for gas pipelines of the pressure ≥ 5 bar and ≤ 16 bar.

According to Art. 20 (Protective belt width), a protective belt should be determined for the distribution pipeline to protect its condition, operation, maintenance and protective layer against external influences. No objects shall be constructed in the protective belt or other activities be performed which could affect and endanger the condition or operation of the distribution pipeline. The protective belt width is determined by the gas distribution network operator according to the technical rules G 462 ("Gas pipelines from steel pipes with operating pressure up to 16 bar - Construction") and G 472 ("Gas pipelines from polyethylene for working pressures up to 10 bar (PE80, PE100 and PE/Xa) – Construction").

When planning the proposed layout of a gas distribution pipeline the designers have to carry out an analysis of the location of the site, taking into account the spatial plans, the position of the constructed and planned gas pipelines, the energy needs of the planned and existing customers in the site concerned, the available distribution pipeline capacity and an analysis of the ownership of the property at the site in question (Art. 25, Route Analysis). When deciding on the route of a distribution pipeline, it should be taken care that it runs through populated areas, in order to create optimal conditions for the connection of future natural gas customers. The distribution pipeline should be located on public properties, and where it is inevitably within the limits of private property with the consent of their owners.

When designing a distribution gas pipeline, the following factors that may arise during construction, testing, maintenance and use of gas pipelines shall be considered:

- loads when installing and testing the distribution pipeline,
- installation of anchors or burial of distribution pipeline,
- road, tram and railway traffic,
- potential subsequent connections to the distribution pipeline,
- other underground facilities,
- flood, ice, snow, wind,
- landslides,
- post-filling of terrain, ditches and the like, and
- above-ground parts of the distribution pipeline.

Also, the following planning principles should be taken into account:

- the pipe dimension should be telescopically reduced with the growth of the distance from the reduction station to the connection point, and
- each place of consumption (load) should be supplied at the shortest way from the delivery point (RS).

However, sometimes the pipe dimension along the pipeline is not reduced because its purpose is also to support the gas consumption of other consumers, in case an other gas supply route needs to be switched off due to maintenance or failure. The second principle relates to economic efficiency and lower cost.

Disposition and placement of shut-off valves

The shut-off valves can be of different design (latch, ball valve or standard valve). They are incorporated into individual gas pipelines or household connections with the purpose to disconnect a single gas pipeline, a part of the grid or facility from gas supply for the purpose of safety or the elimination of malfunctions.

It is much easier to determine the location of the shut-off valves in radial than in annular networks. As damage to gas pipelines is usually caused by third parties, it is necessary to foresee the laying of pipelines in areas which would minimize the risk for such damage. It is also important to know which materials will be used for different segments of the pipeline system. The reason is that polyethylene pipes of smaller diameters can be put out of operation by pressing and in such cases no installation of shut-off valves is required. This is especially possible in low-pressure networks between 100 mbar and up to 3 bar. Another option is to install parallel gas pipelines for certain short system segments to avoid interconnecting the parts of distribution network with long bypass pipelines. Such parallel gas pipelines should be laid on the sidewalks as this would minimize various third-party damages.

In the gas network, a certain number of shut-off valves are typically installed to separate a part of the gas network, separate the individual consumer (user) and separate the gas reduction station. The installation of the shut-off (isolating) valve for individual consumers depends on the amount of gas used (m^3/h), i.e., the connection capacity, size and purpose of use of the facility. As an example, small consumers (households, small services) generally have a shut-off valve on the façade or in a separate area in the basement, while public facilities must have a shut-off valve at the home outlet 1 meter away from the building.

Such places with shut-off valves can usually be a potential place for uncontrolled gas leaks. Therefore, it is especially necessary to maintain these shut-off valves if they are used to turn on or off a particular gas pipeline or part of the grid from the gas supply.

On high-pressure gas pipelines, in particular of larger diameter and pressure, and in passing through bridges or railway and highway crossings, a safety locking valve is installed for the protection of the uncontrolled gas leakage in the event of a fracture, which can be operated locally based on a drop of pressure over time, or remotely from the control and management center (unlike a regular shut-off valve which is operated manually).

Equipment and facilities of gas pipeline also include:

Condensate collectors

Condensate collectors are containers that are installed at the lowest point of the gas pipeline used for the collection of water or liquid hydrocarbons. Water may be due to condensation of moisture from the gas or improper construction and laying of gas pipelines. Sometimes this may be the water residuals, after the pressure test of the gas pipeline with water or the water penetration from the outside through areas of the low-pressure distribution network. Liquid phases in gas pipelines cause improper gas flow, especially in low pressure networks (spill flow). The arrival of a liquid phase in the regulator nozzles or safety devices, could in case of low temperatures result in freezing and improper gas supply.

Vents

Vents are usually installed in a number of gas pipeline points i.e., at their highest points and are used to:

- discharge air from the gas pipeline when filling it with gas (first start-up or after repair)
- discharging gas from the gas pipeline in case of failure and repair.

The place of discharge (exhaust) of gas and gas and air mixtures from the gas pipeline and the part of the grid is particularly important from the safety point of view. In any case, there is always possible presence of explosive mixture near the open gas pipeline or at the ventilation point at certain point of time during maintenance works on DSO network. It is therefore justified to use inert gas (e.g., nitrogen).

Protective pipes

Protective pipes are a part that protects the gas pipeline while passing under railroad tracks, major roads, tramways, streams, sewers, heat pipelines and telecommunication cables.

Anti-breaking valves (block stations)

Anti-breaking valves (block stations) are devices that automatically shut off the gas pipeline in case of fracture or major damage. It works on the principle of sudden reduction in pressure (e.g., by 0.5 bar / min), which cannot be a result of peak gas consumption. Usually the pressure energy from the gas pipeline stored in the attached containers is used. They are installed on high-pressure gas pipelines of larger diameter on both sides of the gas pipeline crossing a bridge or in the characteristic locations of the gas network.

Cathodic protection stations

The cathodic protection stations reduce the intensity of various corrosion processes that could damage the pipeline insulation (during construction or during operation) or mitigate the damage to the gas pipeline due to electric current resulting from the operation of electrical appliances, trains and trams. There are two basic features of the cathodic protection:

- external sources which impose a mains voltage on the gas pipeline which takes over a protective role and which counteracts the impact of wavering currents, or
- galvanic anodes used for short gas pipelines or gas connections, usually where no mains voltage is available, or the application of a cathodic protection stations is too expensive.

The cathodic protection stations require a certain amount of electricity and if they are not automatic, they should be controlled and regulated. Today, cathodic protection stations are typically monitored by a remote monitoring and control system. Cathodic protection as well as anticorrosion protection of the steel distribution gas pipeline in general (e.g., also passive protection) is regulated in detail among others in Section C "Anticorrosive protection of steel distribution gas pipeline" of the Rulebook on conditions for the unobstructed and safe distribution of natural gas through a gas distribution system up to 16 bar²⁴ (Official Gazette of Sarajevo Canton, 40/17).

Gas odorization

Gases used in distribution systems (i.e. natural gas, city gas, or other mixtures of hydrocarbons with other gases) are generally colorless, tasteless and odorless so they cannot be spotted with human senses. It is therefore necessary to add an odor to the distributed gas, so that leakages and faults in the gas distribution network and at the end-user sites are immediately noticed. This process is called odorization. Usually it is considered that the odor must be felt at a presence of gas in the air, at a level 20% below the lower explosive limit. According to the Rulebook on conditions for unobstructed and safe distribution of natural

²⁴ As mentioned in footnote no. 22 there is no similar technical regulation for other DSOs in FBiH, while in RS some elements are present in Rules of operation of the natural gas distribution system adopted for Sarajevo-gas a.d. Istočno Sarajevo and Zvornik stan a.d. Zvornik. Further information are given in System Development Report - International Experience, Status Quo in Bosnia and Herzegovina, Analysis of Gaps and Recommendations.

gas by gas distribution system up to 16 bar (Art 124) natural gas distributed to users shall be odorized in accordance with the requirements of the technical regulation G 260 ("Gas characteristics"). The minimum concentration of odorants (Art 126) should be in accordance with technical regulation G 280-1 ("Gas odorization").

In conclusion, when deciding on the location, the shape of the network and the basic parts of the system, a decision on the type of the network (closed or radial system) needs to be made, which depends on the number of transceiver metering-reduction stations (whether only one or more of them) installed – which is to be coordinated with the development plans of the gas transmission system and with the transmission system operator itself - and on the type of consumers in a specific part of the system (hospitals, schools, kindergartens), i.e., on the purpose of the gas use by different users. The decision also depends on the existence of district heating systems (level of coverage by district heating system and its development plans) and urban planning. And finally, also security of supply considerations and the implications for households and the economy need to be considered. These issues should also be addressed within a gasification (feasibility) study.

3.3 Network design (definition of key network and equipment elements, basic and main design of distribution network, preparation of bills for material, equipment and works)

The elements mentioned in this subchapter should also be covered by and included in the gasification (feasibility) study for the considered territory. As a basis for the design of the network, a general review of the spatial coverage of the territory is used. Territorial sub-units (e.g. local communities) are divided into areas 1 ... n (according to the consumption of heat energy), and as a first step field surveys are conducted in each of them in order to determinate the consumption of heat energy and the needs for natural gas (housing sector, public and private service sector and industrial sector). In further analyses, areas 1 ... n are grouped according to the planned sections of construction of the primary distribution gas network and the associated local reduction stations.

As a next step, the conceptual solution of the gasification of the observed territorial entity is drawn up, including the planned construction of a primary (main parts of the network, usually on higher pressure) and secondary (side parts of the network of smaller diameter and usually on lower pressure) distribution network. This includes primarily the hydraulic calculation of the gas pipeline, usually in several variants (to meet the expected maximum current natural gas needs and the planned maximum future requirements for natural gas, ensuring that the maximum pressure on the local reduction stations is greater than the desired preset pressure).

The route of the primary distribution network is proposed, as a rule, based on the following activities:

- visiting the terrain of the observed area and the potential routes of the primary gas distribution network,
- harmonizing the proposed route with the competent geodetic administration, and
- harmonizing the proposal with the planning documents of the observed territorial unit.

Based on the above, the sections of the primary gas distribution network of the territory, for which the development of a distribution network is considered, and the respective locations of the reduction stations are elaborated.

Some of the criteria for setting up a primary distribution network within a city are:

- shortest connection between industrial consumers or potential industrial zones,
- street profile with regards to possible fit with other installations (electricity, water, telecommunication networks), and
- use of future (planned) roads with planned alignment of installations.

On the map for the considered territory (scale 1:50,000) indicators for the expected gas consumption are to be shown, including symbols for the position of local reduction stations assigned in accordance with expected gas consumption. A closer determination of the capacity of each local reduction station (i.e., 8(6)/3 bar or 8(6)/0.1 (0.2) bar) and within the possible reduction stations (3/0.1 (0.2) bar) is to be performed within the framework of main projects. When determining the scheme of spatial distribution of reduction stations for small consumers (households, small services), the location(s) of connection of the secondary distribution gas network to the primary distribution network is determined.

Hydraulic gas pipeline calculation are to be carried out with commercial software packages. For this reason, in the following only the basic concept and not detailed mathematical models and methods are presented in detail. Each real gas network needs to be transformed into a calculation model (block scheme) in order to simplify the description and to ensure that an error that significantly affects the accuracy of the calculation is not entered. When designing a calculation model, it is possible to merge, for example, branches of close gas pipelines into one node (depending on the gas pipeline diameters and their mutual position) and to perform the according calculations for such established model (pressure p , flow / consumption Q , velocity v and pressure drop Δp in the nodes) and to optimize the pipeline diameters (diameter of individual pipelines and capacity of the reduction stations).

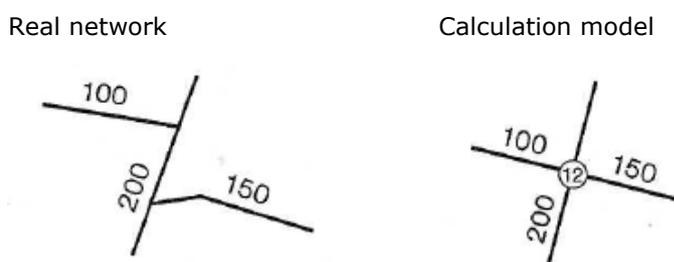


Figure 8: Example of drawing a calculation model - close crossings converted into one node (the exact layout depends on the pipeline diameters and their mutual position)²⁵

After defining the basic elements of the gas network (sections and diameters of the primary distribution network and the positions and capacities of the reduction stations), the following questions are to be answered in order to meet the planned current and future natural gas consumption, and in order to get a proper view of the size of the investment in such a project, based on experiences in gasification projects and the development of the gas networks :

- What is the concept of the gas network, i.e., the physical scope of construction?
- What is the preliminary price of construction of distribution pipelines?
- What is the cost of connection for consumers (mechanical part and construction)?

²⁵ Source: M. Šunić, Plinski sustavi – Distribucija plina, Samobor, 2003

Based on the collected conceptual solutions/substrates and offers for the construction of primary and secondary gas distribution networks for the considered territory (specifying the costs for materials, works and equipment), the expected investment costs can be estimated covering:

- the unit price of the pipeline construction for different pipeline diameters (KM/m) (based on the collected offers from the manufacturers), and
- the unit price for the equipment of the gas pipelines based on the collected offers (a regulating metering station for the whole territory and a reduction station for each settlement (areas of consumption) would generally be sufficient for the distribution networks in operation and currently planned in Bosnia and Herzegovina).

The collected unit prices of the gas pipelines (KM/m) and for the construction of the gas network, include material and mechanical and construction (civil) works (mechanical and construction (civil) works for the installation of PEHD pipes and construction (civil) works for the preparation of land for the laying of pipelines):

- for the primary distribution gas network ($p = 3 - 8$ bar): PE 100 gas pipes,
- for the secondary gas network ($p = 0.1 - 0.2$ bar): PE 80 gas pipes, and
- for (both, primary and secondary distribution networks) pipe material (the value of the pipe material is taken as % of the value of the pipe, and the final value of the pipe material will be aligned with the worksheet of the main project (the choice of pipe material is dictated by the choice of pipe and performance conditions)), excavation of the trench, embedding the pipeline, dispatching surplus material and the cost of work.

According to the Feasibility Study of gasification of Zenica, the construction of the primary ($p = 3$ or 4 bar) and secondary (0.5 bar or 0.1 (0.2) bar) distribution gas pipeline network account for the total construction costs of the (urban part) according to a ratio of approximately $1 : 3$ (meaning 10 km of gas pipelines at 3 or 4 bar corresponds to 30 km of gas pipelines at 0.5 bar (or 0.1 (0.2) bar)), which may be used as a rough estimate also for other planned networks.

Based on the calculation of the primary gas distribution network and the length of the sections between the defined points of consumption (current and planned hourly consumption), the exact concept of the necessary primary gas distribution system is determined, based on which the analysis of the development of the secondary gas distribution network is implemented.

On the basis of the above data - the length of the primary and the secondary gas network and data on the specific costs of material and construction, all by individual diameters - the investment costs for the construction of the distribution network can be determined, considering the specific network structure (length of the distribution network in km, construction works are estimated at a certain percentage ratio between the green and asphalt surfaces), and the cost of materials and works for different construction stages (phases of implementation of particular pipeline sections).

The assessment of the necessary investment is made for each designed (new) gas system (zones) within a single distribution area.

When estimating investment values for a particular system (zone), the following values should be taken into account:

- the purchase price of the pipelines within the area,
- the purchase price of other network assets (crossings of watercourses and roads, shut-off valves, etc.),

- the value of the construction works on the network and its facilities,
- value of previous investment activities (distribution and transmission pipelines, local reduction stations, reconstructions of existing systems),
- the value of works on demining of the terrain, and
- value of costs in resolving property related legal cases.

3.4 Preparing and executing public tenders for purchasing equipment and executing works (according to public procurement rules, applying EU funding provisions where relevant)

The procedures for public procurement in Bosnia and Herzegovina are set by the Public Procurement Law (Official Gazette of Bosna and Herzegovina, 39/2014). For distribution companies it is obligatory to apply this law because they are treated as sectoral contracting entity (Art. 5), pursuant to the definition of sectoral activities defined in Art. 79 (1a) and (1b).

According to the mentioned Law there different classes of public procurement are defined on the basis of the procurement value, mainly:

- when the contract value equals or exceeds BAM 50.000 in the case of goods or services and BAM 80.000 in the case of works, the contracting authority shall apply one of the following five primary contract award procedures: open procedure, restricted procedure, negotiated procedure with or without publication of a procurement notice and design contest (Art. 14 (1)),
- For a sectoral contracting entity purchasing goods and services an open procedure, restricted procedure, negotiated procedure with or without publication of a procurement notice and design contest are to be applied when the contract value equals or exceeds BAM 800.000 (Art. 14 (2) f).
- For a sectoral contracting entity purchasing works an open procedure, restricted procedure, negotiated procedure with or without publication of a procurement notice, design contest and competitive dialog are to be applied and when the contract value equals or exceeds BAM 9.000.000 (Art. 14 (3) f).

Public Procurement Law prescribes several procedures of procurement. For a sectoral contracting entity Art. 19 (2) defines that is obliged to follow open procedure, restricted procedure, negotiated procedure with publication of a procurement notice, equally by choice. Negotiated procedure without publication of a procurement notice and design contest sectoral contracting entity can use as exception, only if additional conditions are met.

Procedures for small value procurement (Art. 87 – 90) are also defined, namely:

- competitive request for quotations, for goods and services up to 50.000 KM and for works up to 80.000 KM, and
- direct agreement, for goods, services and works with estimated value up to 6.000 KM.

It is defined that a contracting authority generally awards a contract based on an open procedure, except in the case when conditions are met for the application of restricted procedure or design contest.

An **open procedure** implies the publication of a procurement notice and a procedure whereby any interested supplier may submit an offer. An open procedure with the simultaneous publication of a

procurement notice in the 'Official Gazette of BiH' and on the web page of the Public Procurement Agency should always be considered as the first choice. An open procedure may even be applied for small-value procurement procedures, when the contracting authority believes that an open procedure will ensure a better quality of the contract (in terms of price and/or quality).

In conducting the open procedure, the contracting authority shall:

- prepare the tender documents according to the provisions of the Public Procurement Law,
- publish a public procurement notice, inviting any interested supplier to request the tender documents and prepare and submit a tender fulfilling the requirements set forth in the tender documents,
- provide suppliers with tender documents,
- organize and carry out public opening of duly received tender,
- verify tenderers' qualifications according to the selection criteria determined in the tender documents, evaluate tenders submitted by qualified tenderers according to contract award criteria determined in the tender documents and award the contract to the tenderer having submitted the lowest priced compliant tender,
- inform tenderers about the decisions reached in terms of tender evaluation, and
- offer the contract to the most successful tenderer.

A **restricted procedure with pre-qualification** refers to a procedure whereby any economic operator wishing to become a candidate may request to participate, but only those candidates meeting certain qualification criteria are invited by the contracting authority to submit a tender. A candidate is defined as a supplier that has submitted a request for taking part in a restricted procedure.

The procedure includes two stages: an open pre-qualification stage and a restricted bids collection stage. Pre-qualification is only one stage of the restricted procedure. "Pre-qualification" means a procedure whereby the contracting authority selects, on the basis of the selection criteria laid down in the tender documents, candidates qualified to be invited to submit a tender in a restricted procedure.

In the first stage, i.e., in the pre-qualification stage, the contracting authority selects candidates, and in the second stage it evaluates the submitted tenders. A restricted procedure may for example be used for the award of a consulting services contract or for large and complex contracts. A 'large or complex contract' is defined as a contract of a high economic value (large scope contracts) and/or high technical and/or organizational complexity (larger construction works, complex information systems, etc.). In such cases, qualification requirements for potential tenderers may be excessive, detailed and demanding, so that pre-qualification in such cases is useful for the contracting authority. A restricted procedure is launched by means of publishing a procurement notice, informing economic operators that the contracting authority intends to award the contract by using restricted procedure and inviting them to submit requests to participate in the procedure by submitting information and documents set forth in the procurement notice as being relevant for pre-qualification.

The contracting authority prepares the tender documents for the first and second stage of a restricted procedure. Deadlines for the submission of requests to tenders depending on the stage of the procedure are defined in the Public Procurement Law. For the first stage a deadline of 18 days and for the second stage a deadline of 28 days (which are to be extended in case of an international tender for a further 12 days) is to be applied.

At the first stage of pre-qualification, a contracting authority requires from a candidate to document its match with the qualification requirements. An evaluation whether a candidate meets the qualification requirements is based on whether a candidate meets the minimum requirement set out by the contracting authority. In the case of a value requiring an international tender, deadlines are extended accordingly.

In line with the qualification requirements, the contracting authority shall select candidates to be invited to submit tenders. The contracting authority is not obliged to carry out a public opening of requests during the pre-qualification stage of the procedure; it is obliged to conduct a public opening of tenders after the call for tenders has been sent to qualified suppliers. After determining qualified candidates, the contracting authority is obliged to inform all those participating in the first stage, of the results and provide explanation to those candidates that did not qualify.

The contract shall be awarded to the selected tenderer having submitted the best evaluated tender. Tender evaluation criteria are either the most economically advantageous tender or the lowest priced technically compliant tender. The contracting authority shall according to the Public Procurement Law simultaneously, but not later than seven days of the decision being made, inform, in writing, candidates or tenderers, having duly submitted requests or tenders, about the decisions reached concerning the pre-qualification and tender evaluation respectively.

In conducting the restricted procedure, the contracting authority shall:

- prepare tender documents; tender documents are prepared in two parts, corresponding to the pre-qualification stage and the tendering stage of the procedure,
- publish a procurement notice inviting any interested candidate to request the pre-qualification documents (if any are provided separately from the procurement notice) and to submit a request for pre-qualification by providing the information and the required documents,
- provide candidates with pre-qualification documents (in case it is provided separately from procurement notice),
- select candidates who will be invited to submit tenders,
- inform the candidates about the decisions reached concerning the pre-qualification - the selected candidates may be informed at the same time when they are invited to submit their bids,
- provide all selected candidates with tender documents at the same time, inviting them to prepare and submit a bid compliant with the requirements defined by tender documentation;
- organize and carry out a public opening of duly received bids,
- assess and compare opened bids against the contract award criteria set forth in tender documents and award contract to a tenderer who submitted the most economically advantageous or the lowest priced compliant bid,
- inform the tenderers about the decisions reached concerning evaluation of the bids, and
- offer the contract to the most successful tenderer.

The contracting authority shall conduct **the negotiated procedure with publication of a procurement notice** under the following conditions:

- in the event that only non-compliant tenders have been submitted in response to an open or restricted procedure, and the contracting authority has repeated the procedure on appropriately amended terms, provided that the contract conditions of the most lately conducted procedure are not substantially altered,

- in exceptional, specific cases of works or services contracts, when the nature of the works or services or the risks attaching thereto do not permit prior overall pricing, or
- in respect of public works contracts, for works which are performed solely for the purposes of research, experiment or development and not with the aim of ensuring profitability or recovering research and development costs.

A negotiated procedure with publication of notice is developed in the following stages:

- a pre-qualification procedure is conducted, as defined for negotiated procedure,
- the contracting authority invites at least three qualified candidates to submit initial bids and to participate in negotiations on the technical, economic, legal and other aspects of the contract,
- based on the result of the negotiations, invites the participants to submit their final bids, and
- schedules public opening of final bids and selects the most advantageous bid.

Negotiated procedure without publication of a procurement notice is used on exceptional basis. The contracting authority may apply this procedure only if conditions defined by Law are met. When the contracts for public procurement of goods, services or works are awarded by means of negotiated procedure without publication of a procurement notice, such procedure may be applied only under the following conditions:

- when no tenders or no suitable tenders have been submitted in response to an open procedure or a restricted procedure, and the contracting authority has repeated the procedure on appropriately amended terms, provided that the contract conditions of the most recently conducted procedure are not substantially altered and all tenderers meeting the minimum qualification requirements are invited to negotiate,
- when no request to participate in a restricted procedure has been submitted or no qualified candidates have requested to participate in a restricted procedure, and the contracting authority has repeated the procedure on appropriately amended terms, provided that the contract conditions of the most recently conducted procedure are not substantially altered,
- when, for substantial, demonstrable technical or artistic reasons, or for reasons related to the protection of exclusive rights, procurements may be conducted, services rendered or works executed only by particular suppliers, and there is no other alternative, or
- when, exceptionally, for demonstrable reasons of extreme urgency brought about by events unforeseeable by the contracting authority in question, the minimum time limits determined by this Law for the accelerated restricted procedure cannot be complied with. Circumstances invoked to justify extreme urgency must not in any event be attributable to the contracting authority.

A negotiated procedure without prior publication of a procurement notice may also be applied in the following cases:

a) In the case of public supply contracts:

- when the products involved are manufactured purely for the purpose of research, experiment, study or development; this provision does not extend to quantity (batch) production to establish commercial viability or to recover research and development costs,
- for additional deliveries by the original supplier which are intended either as a partial replacement of normal supplies or installations or as the extension of existing supplies or installations, where previous contracts were effective, where there is no substantial change in the prices and other

conditions and where a change of supplier would oblige the contracting authority to acquire material having different technical characteristics which would result in incompatibility or disproportionate technical difficulties in operation and maintenance; the length of such contracts as well as that of recurrent contracts may not, as a general rule, exceed one year as of the award of the initial contract,

- for supplies quoted and purchased on a commodity market, or
- for the purchase of supplies on particularly advantageous terms, from either a supplier which is winding up its business activities, or from the receivers or liquidators of a bankruptcy, an arrangement with creditors, or a similar procedure.

b) In the case of public services contracts, when the contract concerned follows a design contest executed according to the provisions of Art. 43 and 44 of the Public Procurement Law, and the contract is awarded to the winner or to one of the winners of the design contest; in the latter case, all the winners shall be invited to participate in the negotiations.

c) In the case of public services and works contracts:

- for additional services or works not included in the project initially considered or in the original contract but which, through unforeseen circumstances, have become necessary for the performance of the services or works described therein, when such additional services or works cannot for technical or economic reasons be carried out or provided separately from those under the principal contract without major inconvenience to the contracting authority. However, such contracts may only be concluded with the contractor to whom the principal contract was awarded, and the aggregate value of contracts awarded for additional services or works may not exceed 50% of the amount of the principal contract, or
- for new services or works consisting of the repetition of similar services or works entrusted to the contractor to whom the same contracting authority awarded an original contract, provided that such services or works conform to a principal project for which the original contract was awarded according to the open or restricted procedure. As soon as the first project is put up for tender, the possible use of this procedure shall be disclosed, and the total estimated cost of subsequent services or works shall be taken into consideration by the contracting authority when estimating the contract value. This procedure may be used only during the three years following the conclusion of the original contract.

During the negotiated procedure, the contracting authority shall comply with the following requirements:

- negotiations shall be held separately with each candidate,
- no information obtained from a candidate or solution proposed by a candidate may be revealed to third parties without the prior consent of that candidate,
- every candidate/tenderer shall be subject to the same requirements and be provided with the same information; equality of treatment among all candidates/tenderers shall be ensured, and
- the proceedings of the negotiations shall be recorded and reported pursuant to the provisions of this Law.

Given that the negotiated procedure without prior publication of a procurement notice is the least transparent and competitive, it should be used in rare, exceptional cases. By awarding the contract in this procedure, the contracting authority risks paying more for poorer quality because the supplier is not forced by competition to lower the price and to guarantee the quality.

A public supply contract may also be awarded after a **design contest** conducted in the cases defined by the Law which implies a procedure enabling the contracting authority to acquire mainly in the fields of spatial planning, town planning, architecture, engineering or data processing, a plan or design selected by a jury after having been put out to competition with or without the award of prizes.

Having conducted the open or restricted procedure, the contracting authority may conclude a **framework agreement**. Pursuant to conclusion of the framework agreement, the contracting authority shall consequently be entitled to conclude agreements with a successful bidder throughout the whole contracting period without using procedures defined by the Public Procurement Law, in terms of any contract awarded according to the framework agreement.

The contracting authority may also consider awarding a framework agreement only if one or several of the following circumstances are present:

- the object of the contract are day-to-day services or consumer goods, not classified as long-term assets,
- the object of the contract are goods or services, whose prices and delivery conditions often change,
- the subject-matter of the contract are continuous repair or maintenance works, or
- where the contracting authority should award several identical contracts within one year, and the framework arrangement would enable reducing the procurement costs. Once a framework agreement is concluded, its terms cannot be changed.

Contracting authorities must not misuse framework agreements or use them in such a way as to hinder, limit or distort competition.

Small-value procurement procedures are as follows.

A **competitive request for quotations** is a procedure in which the contracting authority limits a request for quotations for the supply of goods, services or works to a certain number (not less than three) of suppliers, service providers or contractors for the purpose of awarding the contract concerned. The contracting authority may, in addition, publish a procurement notice in the Official Gazette of BiH. The advantage of publishing an additional notice is a possibility of awarding a contract even if less than three responsive quotations are received.

Request for tenders include adequate and sufficient information for the suppliers to prepare their bids on a genuinely competitive basis. The award of contract is based exclusively upon the lowest price. Deadlines in the competitive request are not defined, but they must be reasonable in terms of the subject-matter and scope of procurement as to enable potential contractors to whom the request was forwarded to have enough time to make a good quality bid.

Where there are less than three responsive quotations, the contracting authority shall cancel the procedure and launch a succeeding renewed procedure.

Direct agreement implies a procedure in which the contracting authority solicits a price proposal or quotation from a single supplier, service provider or contractor and negotiates or accepts that price as a condition for the final agreement. The Law defines direct agreement as a special procurement procedure referred to in the Chapter III. This is a simplified procedure given the procurement value and promotion of cost-effectiveness principles. It is forbidden to split procurement as to avoid the use of transparent public procurement procedures. While preparing and conducting the procurement procedure by direct agreement, the contracting authority should take into account the following:

- procurements should reflect the current needs or purchases that are not covered by the plan or the need for a larger scope of purchase than planned or purchases that are of an urgent nature,
- the same goods, services or works should not be repeated and should not exceed BAM 6,000 at an annual level,
- the contracting authority should bear in mind that the value of procurement is based on prices of previous procurements, i.e., market prices,
- the selection of suppliers is made on the basis of market research, according to the current capacities of the contracting authority, and
- the contracting authority selects the supplier in a manner that guarantees the best value for money.

A bylaw, Instruction for the preparation of tender documentation and bidding model (Official Gazette of Bosna and Herzegovina, 90/14) prescribes that a procurement notice must contain the following information:

- name of the contracting authority, its address, telephone and/or fax number, web site and/or e-mail address if any,
- the service unit at which tender documentation may be obtained, its address, telephone and/or fax number and e-mail address if any,
- type of contract award procedure and information on whether a framework agreement is foreseen,
- intended procurement of goods, services or works, with a brief description of characteristics of the contract object, including an indication of whether the contract object is split into lots and the possibility of tendering for one or more lots,
- place and time limits for delivery of goods and services or performance of works; contract duration, where appropriate,
- indication of whether authorization to submit variants exists or not,
- exact place, date and hour of receipt of tender documents and exact place, date and hour of opening of bids – in the case of an open procedure,
- exact place, date and hour of receipt of request to participate in the case of restricted or negotiated public procurement procedure,
- criteria for evaluation of the tenders defined as “lowest price” or “most economically advantageous tender”. In the case of the “most economically advantageous tender”, sub-criteria should be included which are applied during evaluation of tenders, in descending order of importance, along with the relative weighting given to each sub-criterion,
- a brief description of the requirements regarding the tender and performance securities, if requested,
- language requirements, and
- fee, if any, payable for tender documents, which may be established in accordance with the Law.

“Ordinance with the list of contracting authorities by categories that are obliged to apply the Law on Public Procurement” (“Official Gazette of Bosna and Herzegovina, 21/15) determines (Article 2 (a) item 5) that for transmission or gas distribution or heat energy it is necessary to apply the Law on Public Procurement.

An example for tender documentation can be found on the public procurement website <https://www.javnabavke.gov.ba/legislation> under the headline "Example of tender documentation (original: „Primjer tenderske dokumentacije“).

In general tender documentation for the procurement of goods, services or works (construction) should contain the following:

General data

1. Information about contracting party
2. Information about person responsible for communication
3. Information about legal entities with which the contracting party is in conflict of interest
4. Number of Public Procurement
5. Data about the procurement procedure

Data about the subject of public procurement

6. Description of the procurement
7. Description and labeling of lots (if lot is allocated)
8. Quantity of procurement items
9. Technical specifications of the subject for procurement
10. Place of goods delivery or provision of services or performance of works
11. Deadline for delivering goods or providing services or performing works

Qualification Requirements

12. Requirements for qualification in terms of personal capability and requested evidence
13. Other qualification requirements for the purpose of proving the ability of the bidder and requested evidence

Offer details

14. Content and how to prepare of the offer
15. How to submit the offer
16. How to submit documents jointly (if there is several lots)
17. Acceptance of alternative offers
18. Bid Price Form
19. How to determine the bid price
20. Currency
21. Award Criteria
22. Language and Letter of the Offer
23. Deadline for tender validity

Other provisions

24. Delivery of samples with the offer (if applicable)
25. Place, date and time of receipt of the offer
26. Place, date and time of the opening of tenders
27. Draft contract / framework agreement

28. Warranty for seriousness of the offer
29. Guarantee for execution of the contract
30. Visit a place or location (if applicable)
31. Conclusion of the agreement / framework agreement over a longer period
32. Conclusion of contracts within framework agreement (if applicable)
33. Subcontracting
34. Deadline for making a choice
35. Deadline, manner and terms of payment for the selected bidder

Additional information

36. Costs of the offer and take-over of tender documentation
37. Clarifications and corrections or changes to the tender documentation
38. Confidentiality of data of business entities
39. Modification, amendment or withdrawal of the offer
40. Unnatural low price
41. Legal Remedy

The public procurement website also provides a number of forms and draft agreements covering among others examples of:

- Procurement Notice
- Form for the offer
- Form for the price of goods / services / works
- Statements of personal ability, economic and financial capability, technical and professional capability
- Statement of the bidder referred to in Article 52 of the Law
- Draft agreement for the group of bidders (if bid is submitted by a group of bidders)
- Authorization for representation and participation in the public opening of tenders
- Warranty for the seriousness of the offer
- Draft contract (or framework agreement)

Certain investment projects may benefit from financial support from **EU funds**. The support can range from 10 to 100 percent of project costs and in money from 500 euros to several million euros. There are generally three types of support:

Grants: Support for a specific project, co-financing, not intended for activities that have already been implemented, only one support in the form of grants can be awarded for a specific project.

Loans: available for projects in the private and public sector. Especially for municipalities and small and medium enterprises

Guarantees: available to banks, leasing companies, financial institutions, small and medium enterprises, etc.

The European Commission allocates money in the form of grants, loans and guarantees with the aim of implementing projects or activities in relation to EU policies. This financial support can be awarded in areas such as research, education, health, consumer protection, environmental protection, humanitarian aid.

When European institutions announce a competition they invite candidates to propose within a specified time limit, an action proposal or a project that meets the specific objectives and meets the necessary requirements.

EU funds are intended for: Small and medium enterprises, agencies and chambers education centers, research centers, financial institutions, public administration, civil society organizations, companies, schools and universities.

Bosnia and Herzegovina does currently not have access to all EU assistance programs. As a potential candidate country BiH has two types of assistance:

Transition Assistance and Institution Development – intended for capacity building and institutions – and cross-border cooperation – intended to provide assistance in the field of cross-border cooperation between current member states and candidate and potential candidate countries, and cooperation between candidate and potential candidate countries.

For entrepreneurs, the following three types of assistance are much more interesting, **which will be available in BiH when it receives the status of a candidate country for EU membership**. In this case, funds will be available for:

- regional development – intended for financing infrastructure projects in the field of environment and transport, promotion of competitiveness, balanced regional development and preparation for the European Regional Development Fund,
- human resources development – intended for the preparation of cohesion policy for the European Social Fund, and
- rural development – intended for the preparation of a common agricultural policy.

In case Bosnia and Herzegovina is further progressing on the road to European integration in the near future, businessmen and other institutions should accordingly prepare to get access to these European funds. Further information on EU programs can be found on the pages of the European Commission and the EC Delegation in BiH.

Projects which seek financial support from EU funds, need to match the goal of the EU program from which funding is sought.

Also, the project must be well-designed and executed according to the rules required by each of the EU fund and/or grantor (i.e. European Investment Bank). This includes provisions for the procurement of goods and/or services and works related to the development of gas distribution networks which are co-financed by these grants.

3.5 Construction of the network (appointment of supervisory service providers, organization of the kick off meeting, preparation and execution of project management)

The construction of the gas network is usually conducted in the following order:

- 1) obtain location permit for construction
- 2) prepare project documentation
- 3) obtain all necessary approvals
- 4) resolve property-legal relations

- 5) obtain a building permit
- 6) construct gas distribution network and gas connections
- 7) perform technical inspections
- 8) obtain permit for use

The Ordinance on conditions for unobstructed and safe distribution of natural gas by gas distribution system up to 16 bar²⁶ (Official Gazette of Sarajevo Canton 40/17) Art. 24 ("Application of Standards") states that in terms of general functional requirements distribution pipelines must comply with BAS EN 12007-1 ("Gas infrastructure - Pipelines for maximum permissible operating pressure up to and including 16 bar - Part 1: General functional requirements").

In addition to the general requirements, distribution pipelines from polyethylene shall fulfil specific functional requirements in accordance with BAS EN 12007-2 ("Gas infrastructure - Pipelines for maximum permissible operating pressure up to and including 16 bar - Part 2: Special functional requirements for polyethylene (MOP²⁷ up to and including 10 bar), while distribution pipelines of steel tubes need to fulfil specific functional recommendations for steel in accordance with BAS EN 12007-3 ("Gas supply systems - Pipelines for maximum permissible operating pressure up to and including 16 bar - Part 3: Special functional recommendations for steel").

Steel pipes in distribution networks must also comply with BAS EN ISO 3183 ("Steel pipes for pipeline transmission systems"), while pipe elements must comply with BAS EN 12007-3. Polyethylene pipes in distribution networks must comply with BAS EN 1555-2 ("Plastic piping systems for the supply of gaseous fuel Polyethylene Part 2: Pipes"), whereas pipe fittings must comply with BAS EN 1555-3 ("Plastic piping systems for supply of gaseous fuel Polyethylene Part 3: Sealing") and BAS EN 1555-4 ("Plastic piping systems for supply of gaseous fuel Polyethylene Part 4: Valves")

The choice of the thickness of the pipe wall is done in accordance with BAS EN 12007-3 for steel distribution pipelines and in accordance with BAS EN 12007-2 for polyethylene distribution pipelines.

The Regulation on natural gas supply of Sarajevo Canton²⁸ (Official Gazette of Sarajevo Canton, 22/16) obliges the distribution network operator to monitor the development plans of the Sarajevo Canton and perform the planning of the expansion of the Canton Sarajevo gas system according to these requirements (Art. 80). According to Article 81 the distribution network operator is also obliged, together with the community, to provide the conditions for sustainable development of a company in the domain of satisfying the requirements of natural gas customers and the needs of the community. Furthermore, according to Article 83, the design of parts of the distribution gas system and internal gas installations shall be carried out in accordance with legal and technical regulations and development plans of areas that are gasified.

The distribution company shall furthermore review the project documentation and issue the consent to the project documentation (Article 86), if it is:

- made in accordance with legal and technical regulations,
- in line with the conditions given in the information on the possibility of connection, and

²⁶ As Stated in System Development Report - International Experience, Status Quo in Bosnia and Herzegovina, Analysis of Gaps and Recommendations there is no similar technical regulation for other DSOs in FBiH, while in RS some elements are present in Rules of operation of the natural gas distribution system adopted for Sarajevo-gas a.d. Istočno Sarajevo and Zvornik stan a.d. Zvornik.

²⁷ MOP- maximum operating pressure - maximum pressure at which the system can work continuously under normal operating conditions.

²⁸ Same as footnote no. 25.

- foreseen for an object/building that was built or will be built on the basis of statutory building permits.

Upon completion of works on the construction of internal gas installations, the contractor has to submit a statement of completion of works to the distribution network operator together with the documentation prescribed by the distribution network operator with the request for connection of the newly build gas installations and release of gas flow (Article 91). In order to enable the distribution network operator to start the construction of a customer connection, the investor or gas users must pay the costs of the material for the construction of the connection, the costs of the measuring devices and the associated equipment and their installation, as well as the costs of release of gas flow. In Article 92 it is defined that the distribution network operator exclusively connects the internal gas installations of a user to the distribution network (i.e., a specific site of a gas users can only be connected to a single gas distribution network). Release of gas flow is conducted by the distribution network operator in the presence of the customer or the investor.

Chapter II on the construction, testing, operation and maintenance of a gas distribution pipeline (Article 36 to Article 52) of the same Ordinance, provides a number of definitions covering among others: a working area, the protection of pipelines before installation, construction works, connection of pipelines and parts of the distribution pipeline, welding works, pipe bending, welding technology, visual inspection of welded connections, testing of compounds without destruction, radiographic testing, testing, book of pipes, installation of distribution pipeline, labeling of distribution pipeline, construction of distribution pipeline from PE pipes, geodetic recording.

3.6 Commissioning and start of operation

The procedure for commissioning of the distribution pipeline is described in the provisions of the Ordinance on conditions for unobstructed and safe distribution of natural gas by gas distribution system up to 16 bar (Official Gazette of Sarajevo Canton, 40/17) Section B: Testing the distribution gas pipeline.

Before commissioning, the distribution pipeline is tested on strength and on leak-proofness. The test procedure and test method are to be performed in accordance with the standard BAS EN 12327 ("Gas Infrastructure – Pressure tests, putting in and out from operation - Functional Requirements") and Technical Guideline G 469 ("Pressure testing methods for gas transmission/gas distribution"). The pressure test for the steel distribution gas pipelines must be determined in accordance with BAS EN 12007-3 ("Gas supply systems - Pipelines for maximum permissible operating pressure up to and including 16 bar - Part 3: Special functional recommendations for steel") and Technical Regulation G 469. The pressure test for PE distribution pipelines must be determined in accordance with BAS EN 12007-2 ("Gas infrastructure - Pipework for maximum permissible operating pressure up to and including 16 bar - Part 1: General Functional Requirements") and Technical Rule G 469.

Combined testing (Art. 54) of the distribution gas pipeline and its components on the strength and leak-proofness is carried out at combined test pressure, while the test for the strength of the distribution pipelines is carried out at the strength test pressure (defined according to the abovementioned technical rules). The minimum test pressure when testing the distribution pipeline and its constituents for leaks only can be equal to the operating pressure of the system. After the examination (Art. 57), the medium used for testing must be removed from the distribution pipeline so that it does not affect the environment.

All reports and records on the testing of the distribution pipeline and its components must be signed by the responsible contractor and the person performing the professional supervision (Art. 59).

Upon the results of the pressure test, immediately after the test, a certificate from a professional person or the gas distribution network operator is issued for distribution pipelines up to 5 bar, while for gas distribution pipelines above 5 bar a certificate is issued by authorized experts only (Art. 59). In the form of the receipt for the distribution pipeline, the construction supervision and the contractor confirm the correct installation of the distribution pipeline in accordance with the provisions of the Technical Regulations G-462 ("Steel pipes with operating pressure up to 16 bar - Construction") and G-472 ("Gas pipelines from polyethylene for operating pressures up to 10 bar (PE80, PE100 and PE/Xa) – Construction"), and the expert or authorized expert confirms that there are no doubts as to the results of the conducted pressure test and the commissioning of the examined part of the distribution pipeline to the maximum permissible operating pressure, including maximum permissible operating pressure (Art. 60).

Before putting gas into the distribution gas pipeline, it is necessary to establish that there is no open connection. After that, a part of the distribution gas pipeline with the application of occupational safety and fire protection regulations and the applicable technical rules G 465-2 ("Gas pipelines with operating pressure up to 5 bar - Maintenance") and G 466-1 (Steel gas pipelines with an operating pressure greater than 5 bar - Maintenance") is filled with gas and commissioned, about which a written proof of the procedure is issued (Art 61).

Written proof of the procedure for the release of gas to the part of the gas distribution pipeline (Art 62) has to contain:

- a technical description of the gas distribution pipeline,
- technological procedure of operations during the first filling of the gas distribution pipeline with natural gas,
- the time of commencement and completion of operations when filling the gas distribution pipeline with natural gas,
- the pressure to which the gas distribution pipeline was filled and the amount of natural gas that was required to fill the gas distribution pipeline with natural gas, and
- information on the quantities of natural gas discharged into the atmosphere in the process of filling the gas distribution pipeline.

In addition, pursuant to Art. 90 ("Putting a gas pipeline into operation and putting out of operation"), putting the distribution pipeline into operation, as well as putting it out of operation shall be carried out according to BAS EN 12327 ("Gas infrastructure - Pressure test, putting in and out from operation – Functional requirements"), BAS EN 12007-1 ("Gas Infrastructure - Pipelines for the maximum allowable pressure up to and including 16 bar - Part 1: General Functional Requirements"), BAS EN 1594 ("Pipeline infrastructure - Pipelines for maximum permissible operating pressure above 16 Bar - Functional Requirements") and technical regulations G 466-1 ("Steel pipes for operating pressure greater than 5 bar - Maintenance"), G 465-1 ("Testing of gas nozzles with operating pressure up to 4 bar"), G 465-2 ("Gas pipelines with operating pressure up to 5 bar - Maintenance") and G 465-3 ("Assessment of gas leakage location on underground gas lines in gas networks").

Measuring-reduction stations, reduction stations and measuring stations are examined (Art. 113) by the gas distributor at the place of installation, examining the leak-proofness and functionality. All tests must be carried out in accordance with the requirements of the regulations and technical rules. The test procedure to be applied is determined by the materials to be installed, the type of connection of the individual parts of the distribution pipeline and the facilities and according to the intended area of application. These tests serve to assess the strength and / or leak-proofness of the system being tested and give evidence of plant safety. Testing a gas plant with maximum operating pressure >5 bar which is

not standard, at the place of installation must be carried out by an authorized expert, and for a maximum permissible operating pressure ≥ 5 bar and for a standard plant with a maximum operating pressure > 5 bar a competent expert may be engaged.

The first installation of the plant (reduction station) is defined by Art. 116, according to which the gas pressure regulation may be put into operation after all the tests under Art. 106 of the Rulebook are carried out.

Commissioning should be carried out by an authorized person and with due regard for safety and technical rules and regulations, with the mandatory application of the manufacturer's instructions for putting in place built-in structural elements and groups.

Art. 106 defines the testing of the reduction station by the manufacturer according to which all the structural parts of the reduction station, the metering station and the pressure gauges must be, by the manufacturer, subjected to a test of strength, leak-proofness and functionality. All tests must be carried out in accordance with the requirements of the regulations and technical rules. The test procedure to be applied is determined by the materials to be installed, the type of connection of the individual parts of the distribution pipeline and the plant and according to the intended area of application. These tests serve to assess the strength and/or leak-proofness of the system being tested and give evidence on plant safety.

4 PROCEDURE FOR THE CONNECTION OF A NEW DSO OR NEW DISTRIBUTION NETWORK SEGMENTS TO THE GAS TRANSMISSION NETWORK

Operational procedures for the connection to the gas transmission system in the Republika Srpska are defined in the "Rules of the operation of natural gas transmission system in the Republic Srpska" issued by Gas Promet a.d. Istočno Sarajevo – Pale.

For the Federation of Bosnia & Herzegovina, the operator of the transmission system is, according to the Ordinance on organization and regulation of the gas industry sector (Official Gazette FBiH, 83/07) (Art. 11), obliged to connect those legal persons to the transmission system who have been granted an according consent by the transmission system operator for the connection to the gas system and who have fulfilled the requirements of the bylaws of this Ordinance. Pursuant to (Art. 28), a public invitation to grant a concession cannot be published without the prior opinion of the Ministry, which is issued on the basis of ensuring and fulfilling the condition that the canton(s) gasification study includes a solution for the connection to the existing transmission or distribution system, and that the consent for the connection by the transmission system operator has been obtained.

From the above provisions, it is clear that the consent of the transmission system operator is a prerequisite for the connection to the gas transmission system in the Federation of Bosnia and Herzegovina. **Operational details regarding the connection to the transmission system of BH-Gas d.o.o. Sarajevo are not available from public sources.** In the following, therefore only the procedure for the connection to the transmission network in the Republic Srpska, precisely for Gas Promet a.d. Istočno Sarajevo – Pale, is presented in detailed.

4.1 Obtaining condition for connection to the transmission network (on request of DSO, based on design and location permit)

The connection to the natural gas transmission system is defined by the document "Rules of the operation of natural gas transmission system in the Republic Srpska", issued by the company for import, supply and transmission of natural gas "GAS PROMET" a.d. Istočno Sarajevo – Pale.

The document distinguishes between the transporter and transmission system operator (Art. 2):²⁹

- The Transmission System Operator (TSO) operates the natural gas transmission system in the territory of Republika Srpska and is responsible for the safe, reliable and efficient management and development of the transmission systems including the provision of access, connection and use of the transmission system by third parties under equal and publicly available conditions, interconnection with other systems and the establishment of an efficient system for the recording of transported quantities of gas at all measuring points and the fulfilment of other obligations under the laws and bylaws related to this activity.
- The transporter carries out the transport activities and is responsible for the maintenance of the transmission systems, ensuring the safe, reliable and efficient operation and functioning of the system from the system entry point to the point of delivery of gas, and the provision of the connection, access and use of the transmission system with the consent of the TSO as well as other obligations under the law and by-laws related to this activity.

The TSO is obliged to enable the physical connection of a facility to each person requesting it, in line with the principles of non-discrimination and confidentiality, in accordance with the technical requirements and depending of the degree of the transmission system load (Art. 34).

The applicant for a connection shall submit a request for connection to the existing gas transmission system to the TSO, both for the establishment of a new exit connection from the transmission system, and for the increase of the capacity of an existing exit connection. The application for a connection shall be submitted on the form prescribed by the TSO and shall contain the following information (Art. 37):

- applicant's name and address
- location of the connection
- technical data of the connection
- data about the facility to be connected
- required connection capacity, including the daily and hourly maximums and minimums of the planned delivery, the connection output pressure behind the MMRS (main measuring-reduction station) and the monthly dynamics of natural gas delivery over the next 5 years

The TSO, when deciding on the request for connection to the exit of the transmission system, also takes into account the following: the location of the connection, the available capacity at the connection point and the available pressure at the connection site (Art. 41).

²⁹ The rules of Gas Promet are not very precise on the different roles of the TSO and the transporter. To our understanding they do not reflect the differentiation of the roles of TSO and the shipper or of the transmission system operator and the transmission asset owner (in case the independent system operator model for the unbundling of gas transmission) specified in the EU acquis as adopted for the Energy Community.

In order to protect the integrity of the transmission system, a potential user is only allowed to connect to the transmission system, if its required capacity exceeds 10,000 Sm³ / day (Art. 41).

4.2 Obtaining approval for connection to the transmission network (on request of DSO and based on construction permit by TSO)

The TSO, after the analysis of the submitted request and obtaining the opinion of the transporter within 30 days from the receipt of the request, shall issue a Decision on approval / refusal of the application for entry or exit from the transmission system. The decision on the approval of the connection must include the following information: equipment quality classes and types of measuring equipment, procedures and conditions for the connection to the system, the input pressure and permissible changes in gas pressure, quantity and dynamics of gas injection into the system, connection costs, etc. (Art. 42)

In case the company requesting a connection to the gas transmission system is unsatisfied with the decision of the TSO it may file a complaint at the Energy Regulatory Commission (RERS) within 15 days from the date of delivery of the decision by the TSO(Art. 43).

4.3 Agreement on the connection to the transmission network (concluded between DSO and TSO, based on issued approval, defining financial obligations set according to the Methodology for determining the fee for connection to the gas transmission system)

The TSO determines the connection costs in accordance with the "Rulebook on the methodology for calculating the costs of connecting to a natural gas distribution or transmission system". The user to whom the TSO has issued a proposed solution for a connection to the transmission system may build a connection at its own cost, in accordance with the connection decision, entirely or for certain parts (including construction, mechanical or electrical works). When the user is constructing part of the connection himself, according deductions from the payments of the user to the TSO for the establishment of the connection are made. The TSO concludes a contract for connection to a transmission system with the user regulating the conditions of connection (Art. 44).

The connection contract contains information on (Art. 45):

- contracting parties
- technical conditions of the connected equipment
- technical data on the construction of the connection
- construction period, time and place of connection
- price of the connection and the payment method
- ownership and maintenance of the connection

4.4 Construction, commissioning and start of operation of connection to TSO network (according to signed Agreement TSO is putting constructed connection into the operation)

The TSO together with the transporter contractually regulates the relationships related to the connection of new system users (Art. 46). Connection to the transmission system is carried out on the basis of the contract for connection to the transmission system. The transporter, at the operator's request, carries out the function of connecting the user of the transmission system and for this purpose fills with gas connection of the facility that is subject to connection to the transmission system (Art. 46).

The ownership of gas pipeline connections on the entry and on the exit side of the transmission system will be transferred from the user to the transporter without payment of compensation, based on the contract concluded between them (Art. 47).

5 PROCEDURES FOR THE CONNECTION OF CUSTOMERS TO THE DISTRIBUTION NETWORK

Federation of BiH

According to the Ordinance on the organization and regulation of the gas industry sector (Art. 14), the distribution network operator is obliged to connect to the distribution system all legal and natural persons who have been granted the consent of the distribution network operator. In addition, the user requesting a connection needs to have a construction permit or to document that its building is being constructed on the basis of a construction permit. As for transmission, a gas user may construct a direct pipeline in accordance with the provisions of Art. 25.

The procedures for the connection of gas end-users to the gas distribution network are presented for the territory of the Federation of BiH on the basis of the provisions for the Sarajevo Canton by Ordinance on natural gas supply of Sarajevo Canton (Official Gazette of Sarajevo Canton, 22/16; Art. 84-92), i.e., the procedures of the gas distributor KJKP Sarajevogas d.o.o. Sarajevo

Republika Srpska

According to the Gas Law (Art. 22 (1/1) (2/4)), the Regulatory Commission adopted a methodology for the calculation or the determination of the fees for the connection to the natural gas distribution network and for approving the connection fees for distribution system operators.

Pursuant to Art. 74 (1), the operation and management of the distribution system is governed by the rules of operation of the distribution system, to be consulted with all interested parties and to be approved by the Regulatory Commission. These rules are published on the website of the distribution system operator and in the "Official Gazette of Republika Srpska" (Art. 74 (2)). Mandatory provisions of the rules include among others the rules for the connection of facilities to the natural gas distribution system and for the re-connection of facilities to the distribution system (Art. 74 (3/3)).

For the territory of Republika Srpska procedures for the connection of gas end-users to the gas distribution network and the applicable regulation are presented for Sarajevo-gas a.d. Istočno Sarajevo.

5.1 Obtaining conditions for connection to the distribution network

Federation of BiH

According to Art. 84, an interested party that wishes to connect to the gas distribution network shall submit a request for the possibility of a connection to the distribution company using the form prescribed by the distribution company.

Mandatory attachments to the request about the possibility of connection for:

1. Apartment in an existing building of collective housing:

- Proof of ownership of the apartment
- Copy of cadastral plan - 1 x Original

2. Facilities under construction:

- Copy of cadastral plan - 1 x Original
- Urban permit (location information)
- Proof of ownership – ZK excerpt or Decision on the allocation of construction land (OV)
- Architectural and construction plans substrate with landscaping in ACAD on CD (for objects of collective housing and boiler rooms)

3. Existing self-contained facilities:

- Copy of cadastral plan - 1 x Original
- Proof of ownership - Approval for construction or decision on the legalization of illegally constructed building or a ZK excerpt
- Architectural and conceptual design plans with landscaping in ACAD on CD (for objects of collective housing and boiler rooms) preferably, but not necessarily.

The distribution network operator is obliged to inform the user on the possibilities of a connection to the gas distribution network, providing information on the volume and capacity of the connection, if the applicant has submitted the necessary information, if the technical, energy-related and economic requirements are met, and if increasing natural gas consumption will not jeopardize the supply of other natural gas customers (Art. 85).

Republika Srpska

Pursuant to Art. 74 (1), the operation and management of the distribution system is governed by the rules of operation of the distribution system, which should be consulted with all interested parties and approved by the Regulatory Commission prior to release. These rules are published on the website of the distribution system operator and in the "Official Gazette of Republika Srpska" (Art. 74 (2)). Mandatory provisions of the rules include among others the rules for the connection of facilities to the natural gas distribution system and for the re-connection of facilities to the distribution system (Art. 74 (3/3)).

The Rules for the operation of the natural gas distribution system - Sarajevo-gas a.d. Istočno Sarajevo define (Art. 29) that the system user has the right:

- to submit a request for obtaining the conditions for connection of the facility to the distribution system and the approval,

- on the conclusion of the contract of connection of the facility to the distribution system, the connection of its facilities and the use of the distribution system in a non-discriminatory manner in accordance with the provisions of these Rules,
- to receive from the Distribution System Operator all relevant information regarding the energy requirements for connection, the use of the distribution system, and to, by Distribution System Operator, be promptly informed about the actions related to the use of the distribution system,
- to file an objection to the unauthorized act, omission or failure of the distribution system operator in accordance with these Rules.

Chapter IV¹ defines the process of connecting facilities to the natural gas distribution system.

The connection of the user's facility to the distribution system is carried out in the following procedure (Art. 33 (1-8)):

- the decision on the energy conditions of connection of the facility to the distribution system,
- the examination and approval of the project documentation of the internal gas installation,
- notification of commencement of the works on the internal gas installation by contractor,
- conclusion of contract for physical connection of the facility to the distribution system and gas release for the conduct of the functional testing of the internal gas installation,
- internal technical acceptance of the internal gas installation,
- issuance of energy consent,
- conclusion of the contract on supply of natural gas,
- release of gas for use.

A user who wishes to connect his / her facilities to the distribution system shall, in order to determine the technical and commercial conditions for connection, submit with the request form to the distribution system operator information about (Art. 34):

- the owner of the facility or holder of the right to use the facility with the consent of the owner of the facility (for a natural person: personal name and place of residence, unique registration number of citizens, and for a legal entity: company name, head office, excerpt from the register of economic entities, tax identification number, company identification number, account and responsible person),
- the facility for the connection of which is requested to issue an approval for connection (address, type, location of the object on the copy of the cadastral map),
- the operating pressure of the gas required on the user's premises,
- purpose of natural gas consumption,
- minimum and maximum hourly and daily natural gas consumption and total annual consumption with expected monthly dynamics for facilities with a consumption of more than 16 Sm³/h,
- technical characteristics of facilities of users whose consumption is higher than 16 Sm³/h,
- the possibility of replacing gas with another type of fuel and the time needed for switching to alternative fuel and vice versa for objects whose consumption is higher than 16 Sm³/h.

The request may also contain other data, if requested by the distribution system operator.

The decision determining the energy conditions of connection of the facility to the distribution system, in addition to the parts determined by law, also contains (Art. 35 (1)):

- information about the type and purpose of the facility,
- the diameter of the gas line to which the user's facility is connected,
- pressure at the connection point (minimum, maximum),
- information on the approved capacity at the point of connection,
- data on the approved minimum and maximum hourly consumption and the dynamics of natural gas consumption,
- conditions of use of the distribution system in accordance with these Rules,
- information on the place of delivery and the method of measurement of the delivered natural gas,
- method and technical conditions of connection,
- data on connection costs,
- term of validity of energy conditions,
- instructions on the right to appeal (legal remedy).

The data from the energy conditions serve as the initial data for the design of the internal gas installation (Art. 35 (2)). An integral part of this document is the procedure for connection of new users, with a list of necessary documentation submitted by the user before the internal technical acceptance (Art. 35 (3)). On the energy conditions of connection to the distribution system and connection costs, the distribution system operator shall decide within 15 days from the date of the submission of a proper application (Art. 36 (1)).

Energy conditions shall be issued with a validity period corresponding to the period of construction of the facility, i.e. the completion of works specified in the request for issuing the decision on the approval of connection, and no longer than two years from the date of adoption. For already built objects (i.e. existing buildings and facilities) energy conditions shall be issued with a validity period of six months. At the request of the Applicant, the term of validity of the Energy Conditions may be extended. The request for extension shall be submitted not later than 30 days before the deadline specified in the energy conditions (Art. 37 (1-4)).

The distribution system operator shall verify in the project documentation the compliance of the applied solutions with the energy conditions, rules and standards that apply to this type of installation. Based on the verification of the project documentation, the distribution system operator is obliged to issue a consent to the project documentation or request the necessary harmonization, modification and finalization of the design solutions (Art. 38).

5.2 Obtaining approval for connection to the distribution network

Federation of BiH

The distribution network operator reviews the project documentation and gives the consent to the project documentation, if it is expressed in accordance with the legal and technical regulations, in accordance with

the conditions specified in the information on the possibility of a connection and provided that the facility that will be connected is already constructed or will be constructed on the basis of statutory construction permits (Art. 86).

The approval is issued to the user prior to the connection to the gas distribution network (Art. 87).

In accordance with Art. 88, the interested party submits to the distributor a request for approval of the location (using the form prescribed by the distribution company). The distribution network operator issues a consent to the location of the facility under the following terms:

- the applicant has submitted the documentation required to issue the consent (whose scope and content is determined by the distribution company),
- the foreseen position of the facility during and after its construction does not endanger the safety of parts of the gas distribution system
- the foreseeable position of the facility after its construction does not endanger the realization of the adopted plans for the construction of the gas distribution network.

Operatively, after obtaining Information on the possibility of connection, the investor is referred to the preparation of the Project of Internal Gas Installation (IGI). This service is provided and charged by registered design companies.

A natural or legal person submits a request for the approval of the project documentation covering the area of the Internal Gas Installation (IGI). As a result of the examination of the project documentation, the applicant receives the verified project documentation from the DSO: Approval on the design solutions for the supply and use of natural gas and the approval of connection.

The application is submitted on a form prescribed by the distribution network operator.

Mandatory attachments to the request for issuance of project approval are:

- a project/design in three copies,
- information on connection possibilities (original and copies) for objects that do not have a reduction-measuring station,
- consent to the project of the competent institution for protection against fire and explosion (for facilities P+3 = ground floor + 3 floors), commercial buildings, boiler rooms),
- consent to the project of the competent institution for occupational safety and health (for boiler rooms),
- finding a certified chimney sweeper for the condition of the canal (in the case of a projected gas appliance with a chimney connection).

According to Art. 89 "Obligation to apply the terms of the distributor", the conditions that the distributor prescribes in the information on connection possibilities, in the energy consent and in the consent to the location of the facility are obligatory for the applicant.

Republika Srpska

Pursuant to Rules for the operation of the natural gas distribution system - Sarajevo-gas a.d. Istočno Sarajevo (Art. 43) after the completion of the internal technical acceptance, the distribution system operator issues the approval for connection to the distribution system (Art. 43 (1)).

The approval contains all data as well as conditions and data on (Art. 43 (2)):

- the distribution system operator's approval to the project documentation of the internal gas installation,
- the decision of the municipal commission on the audit of project documentation (where it is for a certain type of gas installation and the capacity of gas appliances prescribed by law),
- contractor's documentation, and
- building permit.

For buildings with multiple measuring points, the approval is issued separately for each measuring point. The approval shall cease to be valid if the user does not enter into a contract with a natural gas supplier within one year from the day of issuing the approval. The approval shall furthermore cease to be valid on the day of permanent separation of the connection from the distribution system.

In order for the distribution system operator to issue an approval for the connection, the following conditions must be met (Art. 44).

Within the internal technical inspection of the distribution system operator and the technical inspection of the competent municipal commission (where for a certain type of gas installation and the capacity of gas appliances this is set by the law) it has to be determined that:

- the internal gas installation was made in accordance with the approved project documentation, with the applicable technical regulations and standards, and that it is safe to use and operate,
- the capacity of the gas appliances is not greater than permissible from the conditions for connection.
- the connection to the system (gas pipeline from the point of connection to the measuring point) and the measuring point are built in accordance with the law governing planning and construction, technical regulations and standards,
- user facilities are constructed in accordance with the law regulating planning and construction, technical regulations and standards, e.g., have a work permit, and
- the user has paid the connection costs and the costs of the gas spent for performing a functional test to the distribution system operator.

The distribution system operator is obliged to issue an Energy Consent (Art. 45) within five days from the date of the completion of the internal technical inspection, i.e. from the date of delivery of the necessary documents from (Art. 43 (2)) by the user, if he determines that the conditions from (Art. 44.) of these Rules are fulfilled.

The distribution system operator shall not be obliged to issue an approval for connection in case it determines that the conditions referred to in Art. 44 of these Rules have not been fulfilled. In the event that the user requests in writing the issuing of an approval and the release of gas for the use of the installation in the facility of the user, the distribution system operator shall issue a decision rejecting the request for issuing the approval and the release of natural gas within eight days of receipt of the application. Upon the decision of the distribution system operator, the user may submit a request within 15 days to the competent inspector to check the fulfilment of these conditions. If the competent inspector determines that the conditions from Art. 44 of these Rules have been fulfilled, he will order the distribution system operator to issue the approval without delay.

5.3 Agreement on connection to the distribution network (defining connection fee based on Methodology for determining the fee for connection to the gas distribution)

Federation of BiH

Further provisions on the construction of internal gas installations related to the connection to the gas distribution network, are defined in Art. 90. After the completion of works on the construction of internal gas installations, the contractor submits to the distribution company a statement on the completion of the works, together with the accompanying documentation prescribed by the distribution network operator (Art. 91). Before the distribution network operator starts the construction of a gas connection, it is necessary for the investor, or contractor in the name of the investor, to pay for the cost of materials for the construction of the connection, the cost of the measuring devices and associated equipment as well as their installation, and the costs of the gas release.

Operatively, after the completion of the works on the construction of the internal gas installation, at its customer center, the DSO performs the calculation and invoicing of the costs of the construction of the connection and the installation of the measuring device in order to obtain the price of construction of a concrete connection. Payment can be made immediately at the cashier of the customer center. Immediately after the payment of the costs by the investor (or the contractor), a request is made for the opening of an order for the construction of the connection and the installation of a measuring device.

Republika Srpska

According to the Gas Law (Art. 22 (1/1) (2/4)), Regulatory Commission shall adopt a methodology for calculating the fees for connection to the natural gas distribution system and approving the fees for connection to the natural gas distribution system for energy entities that carry out the distribution activity. The costs of connection shall be determined by the distribution system operator on the basis of the Rulebook on connection and shall be borne by the applicant for connection. (Art. 30 (2) and Art. (31)).

Rulebook on the methodology for calculating the costs of connecting to a natural gas distribution or transmission system (Official Gazette of Republika Srpska, 51/14) is regulating the method of calculating the fee for connection to the distribution system or natural gas transmission system.

In the case of the Rules for the operation of the natural gas distribution system - Sarajevo-gas a.d. Istočno Sarajevo, (Art. 106) the contract on connection to the distribution system is concluded by the distribution system operator and by the user who is in the process of connection to the distribution system and in the procedure of increasing the connection capacity or by the investor of residential and commercial buildings and / or business facilities in the procedure of connection to the distribution system and in the procedure for increasing the connection capacity. The agreement on connection to the distribution system regulates the conditions of connection to the distribution system and financial obligations in accordance with the Rulebook on connection.

5.4 Construction, commissioning and start of operation of connection to the distribution network

Federation of BiH

Only after obtaining the verified project documentation and consent, the user requesting a connection to the gas distribution network can organize the commencement of works for the construction of the internal gas installation. The customer center of the DSO provides the applicant with a list of contractors, which

can perform works on the construction of an Internal Gas Installation and with instructions on the next steps.

From the list of contractors (companies that passed the commission check and fulfil the prescribed conditions) the investor hires an authorized company from the list that will perform the works on the construction of an internal gas installation. This service is provided and charged by companies that have signed a contract with the DSO (e.g., KJKP Sarajevogas d.o.o. Sarajevo).

Upon agreement with the investor, the selected contractor submits the Application on performance of works to the DSO, starts the work on the construction of the internal gas installation and, upon completing the execution of the delivery, the provides a Declaration of completion of the performance with the request for the first release of gas.

In addition to the Application and Declaration of completion of the works, the contractor, with the request for inspection of the internal gas installations and the first release of gas, encloses the following documentation:

- certified project of internal gas installation to which the approval of the DSO was issued (1 copy),
- approval for connection by the DSO (1 copy - photocopy),
- certificate or positive report of the laboratory of the Research and Development Center for Gas Technology on compliance with the standard of installed elements in the gas installation (shut-off valve, flexible connections, appliances, coupling elements),
- consent of a chimney sweeper after the installation of a gas appliance (if gas appliances are connected to the installation where the outgoing gases are drawn into the atmosphere through a chimney) – original,
- a record of the strength test and leakage test performed,
- a record of cleaning and discharging carried out on gas installation,
- anti-corrosion protection record (if applicable),
- an attest of the welder,
- a record on the performed testing of electrical installation for the connection of the gas boiler,
- a record of the fire protection test for gas installations in the facilities for which is required by the Fire Protection Act,
- the contractor's statement that IGI has been done in accordance with the technical rule G 600 and that the installation is ready for operation (connection), and
- operating instructions for IGI.

After the installation of the measuring device, the term of the first gas release to the installation of the user is agreed upon, for which the presence of the contractor, the servicer of the gas appliance and the chimney sweeper is obligatory (if a gas appliance is connected to the chimney). At the time of the first gas release, if there are no objections to the performed works, the DSO signs the contract on natural gas supply with the investor and delivers the technical documentation.

Republika Srpska

Pursuant to (Art. 39) of the Rules for the operation of the natural gas distribution system - Sarajevo-gas a.d. Istočno Sarajevo, the user is obliged to submit to the distribution system operator in writing the

request for physical connection of the facility to the distribution system and the release of natural gas for conducting a functional test of the internal gas installation (Art. 39 (1)). In order for the distribution system operator to physically connect the facility to the distribution system and to release the gas for conducting a functional test, the user is obliged to submit together with the request (Art. 39 (2)):

- a written statement of the contractor that the internal gas installation has been made in accordance with the verified project documentation, applicable technical regulations and standards, and that it is safe and ready to carry out a functional test. The Contractor's statement must be signed by the supervisory authority, and
- written statements by the contractor and the supervisory body on taking responsibility during the performance of a functional test.

The distribution system operator is obliged to issue a decision on the physical connection of the facility to the distribution system and the release of natural gas for the purposes of a functional test within eight days from the date of receipt of the application, if it determines that the requirements of Art. 39 (2) of the Rules are fulfilled. The decision, with prior agreement with the user, determines the exact date (term) of the release of natural gas, which cannot be longer than 3 days from the day of completion of works on the connection execution. Upon the adoption of the solution, the distribution system operator and the user sign the contract on connection to the distribution system. By decision, and depending on the type and complexity of the internal gas installation, the maximum time for the use of a natural gas for a functional test, which cannot be longer than 15 days, is also determined (Art. 40).

The contract on connection to the distribution system contains (Art. 106) data on the contracting parties, number of the connection approval, technical conditions of connection, technical data on connection construction, amount of connection fee, method of payment, deadline for connection construction, time and place of connection and other provisions.

The user is obliged to submit the request for internal technical acceptance to the distribution system operator in writing within 5 days from the day of completing the functional test. Upon request, the user shall enclose all necessary documentation in accordance with the Law on Spatial Planning and in accordance with the requirements of the gas distribution system operator specified in the Energy Regulations (Art. 41). The distribution system operator shall perform internal technical reception within 10 days from the date of receipt of the request and deliver the results of the receipt to the user within 5 days from the date of completion of the internal technical acceptance. On the basis of the performed internal technical acceptance, the distribution system operator shall be obliged to issue an approval for the performed internal gas installation or to request the elimination of defects, changes and modifications of the elements of the internal gas installation (Art. 42).

After the internal technical inspection and the obtaining of the approval for connection, the user concludes a contract for the supply of natural gas in accordance with the Gas Law, General Conditions for Supply of Natural Gas and other regulations issued in accordance with the Law and these Rules (Art. 47)

The distribution system operator shall be obliged to release natural gas for use within eight days from the day the user concluded the supply contract. The exact date (term) of the release of natural gas must be agreed between the distribution system operator and the user, and the release of gas is done in the presence of the user, for which the relevant record must be made (Art. 47). If the distribution system operator does not release natural gas for use until the agreed date (term), the user may apply to the competent inspector to check the fulfilment of the conditions for the release of natural gas. If the competent inspector determines that the conditions from (Art. 44) of these Rules have been fulfilled, he will order the distribution system operator to immediately release the natural gas for use in the user's facility (Art. 49).

The gas connection is filled with gas by the distribution system operator. After filling-in of the connection, the distribution system operator is obliged to determine that the leakage test of the connection has been successfully performed and to make the record of it (Art. 50).