



Natural Gas Basics

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Natural Gas

Introduction

This publication provides information about a municipal gas system (local distribution customer - LDC). It is not intended to be an all-inclusive detailed discussion on natural gas. There are a substantial number of natural gas topics not discussed in this primer.

Natural gas is an energy source used by many Tennessee residents. Natural gas in its refined form is almost 100 percent methane (CH₄). In this refined state, the gas is odorless and colorless with a high energy output when it is burned. It is an excellent energy source that burns cleaner than most other fossil fuels.

Natural gas is provided to customers in Tennessee either by a municipal gas system, a natural gas utility district, or a private natural gas company. There may be a county natural gas system in Tennessee. Natural gas competes with electric systems for customers, but also has electric generators as customers.

Providing natural gas to a city is an involved process and most small and medium size cities rely upon others to assist them. The process of delivering natural gas to homes begins with natural gas producers withdrawing the gas from the earth, processors refining the gas, interstate and intrastate pipelines transporting the gas, gas suppliers marketing the gas, financial institutions funding the ventures, companies acting as agents, federal and state regulations controlling the process, and local gas distribution employees maintaining reliable and safe natural gas delivery to end users.

Natural gas is traded on the New York Mercantile Exchange (NYMEX) as an energy commodity.

Natural Gas Facts

As an energy source, natural gas provides energy for five consumer groups. Below is a table listing how much gas each group consumed in 2023. The numbers are in billion cubic feet.

Residential	4,995
Commercial	3,525
Industrial	8,455
Electric Power	12,118
Vehicle Use	53

Total consumption 32,318
Average heating value per cubic foot was 1,036 Btu.

(Information provided by U.S. Energy Information Administration, February 2023)

Terms and Definitions

Balancing: The method or service that an agent or LDC uses to match the customer's daily usage with the customer's contracted delivery from the pipeline.

Btu: One British thermal unit, the amount of heat required to raise the temperature of one pound of water one-degree Fahrenheit from 60 degrees Fahrenheit to 61 degrees Fahrenheit at standard barometric pressure.

City gate: The point of connection to the supplier's pipeline and the LDC.

Cu ft: One cubic foot of natural gas (that equals approximately 1,025 Btus). Natural gas varies somewhat in heat content depending on origin.

Dekatherm: The quantity of heat energy that is equivalent to one million British thermal units or ten therms.

FERC: Federal Energy Regulatory Commission.

Firm transport contract: A pipeline transportation contract by which a specific amount of natural gas is delivered.

Fixed cost: The cost per unit is fixed (set) at the time of purchase by the seller and purchaser. The amount of gas to be purchased and the timeframe for the contract are finalized.

Gas day: A 24-hour period usually starting at 9 a.m. Central Time.

Imbalance: When a customer uses either less or more gas than was contracted.

Interruptible transport contract: A transportation contract in which a specific amount of natural gas may be delivered but is not guaranteed. This type of contract has a lower priority than a firm or no-notice contract.

Interstate pipeline: A natural gas pipeline that operates in multiple states.

Intrastate pipeline: A natural gas pipeline that operates within only one state. It does not cross any state lines.

Market index: The purchaser and seller agree upon a specific market index for the cost of gas for a specific month and, possibly, at a specified geographical location such as Henry, Louisiana (i.e., "Henry Hub").

Market index with discount: The purchaser and seller agree upon a specific market index for the cost of gas for a specific month with an agreed-upon percentage discount for the index price. This usually is tied to long-term purchase agreements

between the two parties.

Mcf: 1,000 cubic feet of gas that equals approximately 1,025,000 Btus or 1.025 MMBtu (This conversion will vary from roughly 1.02 to 1.04 depending upon the natural gas heat content).

MMBtu: One million British thermal units.

Nomination: An electronic or written request for a physical amount of natural gas purchased under a specific contract and transported under a specific type of transportation contract to a specific city gate or entry point into the local natural gas system. This will be for a specific period. Before the gas is delivered it must be confirmed by the pipeline that all the contracts under the nomination are valid and correct.

No notice: A transportation contract with storage included.

Scheduling: Occurs when natural gas volume nominations are combined at a point on the pipeline and the contracts are verified. If the volume nominated matches verified capacity, the gas is scheduled to be delivered.

Third-party transport customer: This usually is an industrial customer who purchases natural gas and transportation without using the LDC's transportation contract. The LDC then charges this customer a transportation fee to deliver the gas from the city gate through the LDC pipeline to the customer's meter. The agent or LDC must maintain records of the amount of gas the customer nominated for delivery to the city gate versus what the customer consumed. The difference must be balanced at the end of every month.

Therm: The quantity of heat energy equivalent to 100,000 Btus.

Weighted average cost of gas (WACOG): The average cost of all gas purchased during a specific period.

Supply

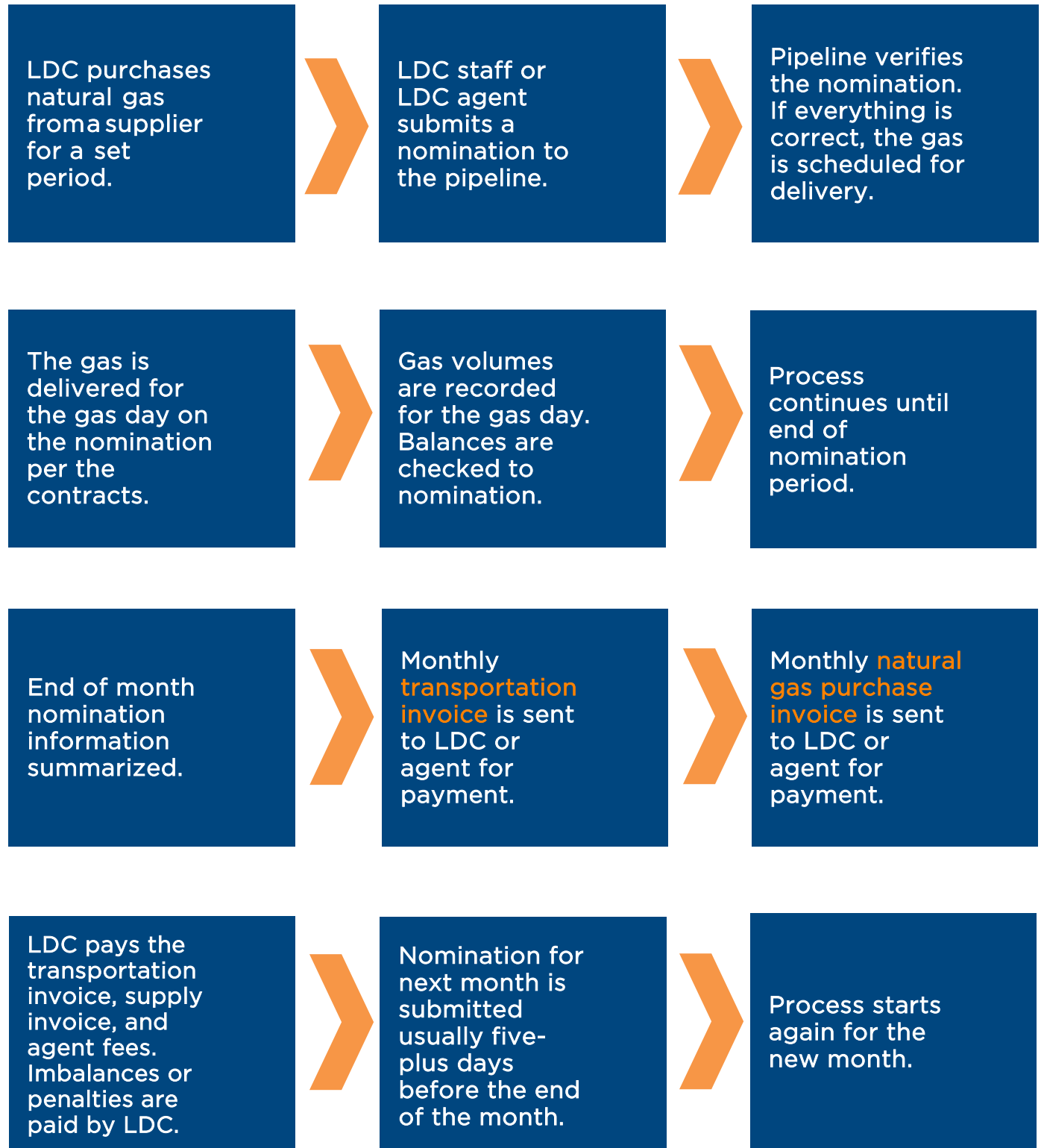
Natural gas is trapped in the earth under impermeable layers of rock. To harvest it, a producer drills a production well through the impermeable layer to allow the natural gas to escape into the collection system. It is then sent to a refinery for impurities to be removed prior to it being piped to customers or storage.

The producer may market its gas directly to the consumer or sell its gas to a marketer who then provides it to consumers. The LDC may purchase the natural gas from a producer or marketer. The purchase contract should specify the length of the contract, the amount of gas to be purchased, and the geographical point at which the gas is put into the interstate pipeline. In the United States, natural gas is purchased in units of either MMBtu or dekatherm. The purchased gas must be transported through a pipeline to the LDC for consumption.

Interstate Pipeline

The LDC will have at least one transportation contract with an interstate pipeline. The interstate pipeline is regulated by the Federal Energy Regulatory Commission (FERC) (www.ferc.gov). FERC Order 636 was part of the federal process to deregulate the natural gas industry. This order states that an interstate or intrastate pipeline can only transport, manipulate or store natural gas. With this order a pipeline can no longer sell natural gas. The consumer is required to purchase natural gas from an entity other than the pipeline. Prior to this order, LDCs purchased transportation and pipeline services from the pipeline.

Natural Gas Process



Agent

In Tennessee, a significant percentage of utilities (LDC) use an agent to manage their natural gas purchases, nominations, daily balancing, allocation, and other pipeline/supply issues. The LDC signs formal documents with the pipeline and suppliers that allow the agent to conduct business using the transportation contracts, supply rights, storage rights, and other rights.

The agent monitors the LDC's gas activities at the city gate, storage activities, storage amounts versus predicted levels for the gas year, contract balancing, and gas pricing on NYMEX.

The agent remains in contact with the pipelines, suppliers, and other parties involved in natural gas deliveries. They should function as the watchdog for the LDC. The agent should alert the LDC of market trends or industry actions that may be detrimental to the system.

The LDC staff must collaborate closely with agents in forecasting future gas needs, current usage trends, and how to prepare for them, when and how to purchase gas and other issues. Communication should be frequent and frank between the LDC and the agent.

A municipal gas system may choose a municipal energy acquisition corporation or a municipal gas authority for its gas supply and to function as the agent for the LDC. The corporation or authority may work in several states.

Fuel Percentage

The LDC must purchase more natural gas than it needs because a portion of the gas purchased is used to provide fuel for the pipeline turbines that push the gas through the pipes. This fuel percentage is normally two to nine percent of the amount needed at the city gate. The further the gas pumped from the supply the higher the percentage.

Example

The LDC wants one hundred MMBtus delivered. Its firm transport contract requires five percent for fuel, so the LDC purchases 105 MMBtus from its supplier, and the gas is injected into the system. The pipeline keeps 5 MMBtus for fuel and delivers one hundred MMBtus to the city gate.

Transportation Contracts

The most common types of transportation contracts used by municipal gas systems are the firm transport contracts and no-notice transport contracts. There are other types of transportation contracts available. An example of another type of contract is an interruptible transportation contract. This type of contract is normally used by large manufacturers to move gas due to the lower cost associated with the contract.

These customers must have a propane or liquefied natural gas backup system on site if the contracted gas is not allowed to flow due to the low contract priority. A municipal system normally does not use an interruptible contract due to the lower level of security for delivery of the gas and the additional cost of having a backup system.

A **firm transport contract** delivers a specific amount of gas to the city gate. It does not have any storage rights on the pipeline. Most small and medium LDCs do not use these types of transportation contracts because penalties are assessed against the LDC if it incorrectly estimates the gas needed and has an imbalance. Each transportation contract has a daily maximum number of MMBtus that can be delivered. Depending on the type of contract, an LDC may have an imbalance with either under-deliveries or over-deliveries of gas. The firm transport contract must deliver the amount nominated. If it varies, it creates an imbalance on the pipeline. At the end of the month if the agent or LDC has not corrected the imbalance the pipeline can assess penalties to the LDC. If the LDC used more gas than it nominated, the pipeline also will charge the LDC for the gas at a market-cost-plus price. If the LDC used less gas than it nominated, the pipeline will pay for the gas usually at less than market cost. The imbalance penalties and costs are explained in the pipeline contract and tariffs.

Examples

- A. The LDC wants one hundred MMBtus delivered. Its firm transport contract requires five percent for fuel for the line compressors, so the LDC purchases 105 MMBtus from its supplier, and the gas is injected into the system. The pipeline keeps 5 MMBtus for fuel and delivers one hundred MMBtus to the city gate. The LDC used one hundred MMBtus during the gas day and there is no imbalance.
- B. The LDC wants one hundred MMBtus delivered. Its firm transport contract requires five percent for fuel for the line compressors, so the LDC purchases 105 MMBtus from its supplier, and the gas is injected into the system. The pipeline keeps 5 MMBtus for fuel and delivers one hundred MMBtus to the city gate. The LDC uses 80 MMBtus during the gas day. This is an imbalance. The pipeline has 20 MMBtus that the LDC nominated, and the gas has nowhere to go.
- C. The LDC wants one hundred MMBtus delivered. Its firm transport contract requires five percent for fuel for the line compressors, so, the LDC purchases 105 MMBtus from its supplier, and the gas is injected into the system. The pipeline keeps 5 MMBtus for fuel and delivers one hundred MMBtus to the city gate. The LDC uses 135 MMBtus during the gas day. This is an imbalance. The LDC used 35 MMBtus that it did not nominate or purchase.

Examples B and C will trigger penalties and other costs at the end of the month if the LDC or agent does not correct the imbalance before the end of the month. The pipeline will not correct the imbalance. The agent or LDC must monitor deliveries and work to correct imbalances before the end of each month.

A **no-notice contract transport contract** delivers a specific amount of gas to the city gate, and it has storage rights on the pipeline. Thus, if the LDC does not use all the gas nominated on the contract for the gas day, the unused amount automatically is credited to the storage account associated with the contract. On a day that the LDC consumption is greater than the nominated amount, the difference is automatically subtracted from the storage account. The contract establishes the number of MMBtus that can be stored.

During the winter months the no-notice contract gas delivery mechanism is different than in other months. There is a daily maximum amount for purchased and nominated gas, and there is a separate maximum amount of gas that can be withdrawn from the storage account. These two amounts added together specify how many MMBtus can be delivered on the no-notice contract for a gas day.

Examples

- A. The LDC nominated one hundred MMBtus to be delivered on a no-notice contract with a five percent fuel rate during June. The LDC purchased 105 MMBtus, and the pipeline used 5 MMBtus for fuel leaving the LDC with one hundred MMBtus available at the city gate. The LDC used 85 MMBtus during the gas day. Fifteen MMBtus were automatically credited to the storage account associated with the no-notice contract.
- B. The LDC nominated one hundred MMBtus to be delivered on a no-notice contract with a five percent fuel rate during January. The no-notice contract has a daily maximum of 175 MMBtus, of which one hundred may be nominated and seventy-five may come from storage. The LDC purchased 105 MMBtus, the pipeline used 5 MMBtus for fuel, and the LDC had one hundred MMBtus available at the city gate. The LDC used 165 MMBtus during the gas day. The nomination was one hundred, which is 65 MMBtus greater than the gas used. The pipeline automatically debited the storage account associated with the no-notice contract 65 MMBtus to balance the delivery.

Storage

Natural gas can be stored in a depleted natural gas field, an underground salt cavern or a liquefied natural gas storage facility. When needed on the pipeline to balance demand, the gas is removed from the storage area and pumped into the system. Storage accounts are matched to gate deliveries and nominations to track storage activity.

A no-notice contract normally has storage rights associated with it. An LDC may contract for additional storage.

Local Natural Gas System

The municipal gas system takes delivery of the natural gas at its city gate. The pipeline gas pressure is reduced to system operating pressure, and an odorant is injected into the gas to assist in detecting leaks. Gas metering and maintenance are

major components of a natural gas system's workload.

The local gas department must have certified gas operators whose education and training must be documented and kept current. The Tennessee Public Utility Commission (<https://www.tn.gov/tpuc.html>) is responsible for natural gas pipeline safety.

The system also may have a third-party transport customer. This is an industrial facility that buys its own gas and transports the gas on its own transportation contract to the municipality's city gate. The local gas system transports it from the gate to its facility and charges the industrial customer a transport fee. The city must keep up with the usage and compare it to the daily nominations to avoid imbalances within the LDC.

Conversion of MMBtu to Mcf

The LDC purchases natural gas in units of energy (MMBtu) but sells gas to customers in volume (Mcf). The amount of energy delivered is checked every day on each segment of an interstate pipeline.

At the end of the month the agent or LDC will receive a summary of the daily MMBtu level delivered in each segment. It will vary from day to day, and it will change gate station delivery totals. Below is an example of how the units are converted within the LDC.

Example

The LDC had one hundred MMBtus delivered at the gate station and used all one hundred MMBtus for the gas day. The energy content was 1.032 MMBtus for the day.

$$\text{Mcf} = \text{MMBtu}/\text{energy content}$$

$$\text{Mcf} = 100 \text{ MMBtu}/1.032$$

$$\text{Mcf} = 96.89$$

By volume, 96.89 Mcf were delivered to the city gate, which equals the one hundred MMBtus.

Tennessee 811

The natural gas industry is a major part of the Tennessee 811 system. This is the underground utility notification center for Tennessee. The Call Center phone number is 811 or 800-351-1111 or 615-366-5021. The web site is TENN811.COM.

Regulators

There are various regulatory agencies which have oversight responsibility of the natural gas system.

1. Tennessee Public Utility Commission:

a. Pipeline Safety Division

The mission of Tennessee Public Utility Commission's (TPUC) Gas Pipeline Safety Division (GPSD) is to contribute to the safety and reliability of intrastate natural gas distribution and transmission pipeline facilities by conducting pipeline safety inspections across the state. It is the goal of the staff to minimize the risk to public health and safety because of the unintended release of natural gas from a pipeline. Public health and safety also depends on maintaining the flow of natural gas as a source of energy necessary to sustain domestic, commercial, and industrial activities. In support of this effort, pipeline safety inspections by the Tennessee Public Utility Commission's GPSD promote pipeline integrity and reliability. The Gas Pipeline Safety Division inspections promote underground utility damage prevention and public awareness of gas pipeline safety issues. Third party excavation is the leading cause of damage to underground utilities making damage prevention of utmost importance.

<https://www.tn.gov/tpuc/divisions/gas-pipeline-safety-division.html>

b. Utilities Division

The Utilities Division assists the Commission in establishing and implementing policy regarding Tennessee's gas, water, sewer, wastewater, electric, and telephone companies to result in fair and responsible regulation for all utility companies and consumers in the state. A diversified team consisting of engineers, accountants, economists, rate specialists, and research analysts is employed to provide technical and financial expertise to ensure that the statutory responsibilities and rules of the Commission are fulfilled. The Division provides thorough research for companies wanting to provide utility services in Tennessee and companies already serving the state are routinely investigated as to the rates, terms, and conditions of services provided to consumers. The duties of the Division are balanced with the technological advances within the energy and water and telecommunications industries along with Federal and State legislation to achieve its goals.

2. U. S. Department of Transportation, Office of Pipelines and Hazardous Materials Safety Administration (PHMSA)

PHMSA's mission is to protect people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential to our daily lives. To do this, the agency establishes national policy, sets, and enforces standards, educates, and conducts research to prevent incidents. We also prepare the public and first responders to reduce consequences if an incident does occur.

<https://www.phmsa.dot.gov/>

3. Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission, or FERC, is an independent agency that regulates the interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects. The Energy Policy Act of 2005 gave FERC additional responsibilities as outlined and updated [Strategic Plan](#). As part of that responsibility, FERC:

- *Regulates the transmission and sale of natural gas for resale in interstate commerce.*
- *Regulates the transportation of oil by pipeline in interstate commerce.*
- *Approves the siting and abandonment of interstate natural gas pipelines and storage facilities.*
- *Assess the safe operation and reliability of proposed and operating LNG terminals.*
- *Monitors and investigates energy markets.*
- *Enforces FERC regulatory requirements through imposition of civil penalties and other means.*
- *Oversees environmental matters related to natural gas and hydroelectricity projects and other matters; and*
- *Administers accounting and financial reporting regulations and conduct of regulated companies.*

Associations

There are associations which can provide information and guidance for your natural gas utility.

- [Tennessee Gas Association – Natural Gas, Naturally Better \(tngas.org\)](http://tngas.org).
- American Gas Association. [American Gas Association | Clean Natural Gas | American Gas Association \(aga.org\)](http://American Gas Association | Clean Natural Gas | American Gas Association (aga.org)).
- Partners in Protecting Everyone (PIPE). This is a pipe safety organization. [Tennessee Pipeline Awareness \[Affected Public\] \(pipeline-awareness.com\)](http://Tennessee Pipeline Awareness [Affected Public] (pipeline-awareness.com))

Concerns for Local Officials

- **Maintaining trained and certified staff.** The city needs qualified and trained people to manage this necessary but potentially dangerous energy source.
- **Maintaining an adequate natural gas infrastructure to meet current and future demand.** The system must be in good repair to keep the gas flowing and be available for new customers.
- **Cost of supply (short and long term).** No one can forecast market trends. A goal for elected officials is to purchase natural gas for the system at a reasonable cost.
- **Expenses versus rates charged to customers.** The financial situation of the gas department must be closely monitored due to the volatility of the market and cost of supply.
- **Flexibility and reliability of supply, either supplier, marketer, or agent.** All

suppliers may not be able to totally supply your contract during a force majeure, but some suppliers may be able to deliver more gas than others.

- **Agents' abilities and communications to the LDC.** They must listen to you and you to them. They must be dependable and diligent in looking after your affairs.
- **Safety.** Natural gas is a dangerous energy source if it is managed in an unsafe manner. The safety of the citizens and employees of a city should be a priority.
- **Growth.** The system must prepare for growth internally as well as on the pipeline.
- **Under Tennessee law, revenue from a municipal gas system may not be used to support other operating departments of the municipality.**



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