

NATURAL GAS PRIMER FOR ELECTED OFFICIALS

By Steve Wyatt, Utility Operations Consultant

THE UNIVERSITY of TENNESSEE 
MUNICIPAL TECHNICAL ADVISORY SERVICE

In cooperation with the Tennessee Municipal League



NATURAL GAS PRIMER FOR ELECTED OFFICIALS

May 2008

Steve Wyatt
Utility Operations Consultant

MTAS OFFICES

Knoxville (Headquarters)	(865) 974-0411
Johnson City	(423) 854-9882
	(423) 282-0416
Nashville	(615) 532-6827
Jackson	(731) 423-3710
Martin	(731) 881-7057

www.mtas.tennessee.edu

The Municipal Technical Advisory Service (MTAS) was created in 1949 by the state legislature to enhance the quality of government in Tennessee municipalities. An agency of the University of Tennessee Institute for Public Service, MTAS works in cooperation with the Tennessee Municipal League and affiliated organizations to assist municipal officials.

By sharing information, responding to client requests, and anticipating the ever-changing municipal government environment, MTAS promotes better local government and helps cities develop and sustain effective management and leadership.

MTAS offers assistance in areas such as accounting and finance, administration and personnel, fire, public works,

law, ordinance codification, and water and wastewater management. MTAS houses a comprehensive library and publishes scores of documents annually.

MTAS provides one copy of our publications free of charge to each Tennessee municipality, county and department of state and federal government. There is a \$10 charge for additional copies of "Natural Gas Primer for Elected Officials."

Photocopying of this publication in small quantities for educational purposes is encouraged. For permission to copy and distribute large quantities, please contact the MTAS Knoxville office at (865) 974-0411.



NATURAL GAS PRIMER FOR ELECTED OFFICIALS

INTRODUCTION

This publication provides basic information to municipal elected officials concerning natural gas as it relates to a municipal gas system or local distribution customer (LDC). It is not intended to be an all-inclusive detailed discussion on natural gas. There are a significant number of natural gas topics not discussed in this primer.

Natural gas is an energy source used by a large number of Tennessee residents. Natural gas in its refined form is almost 100 percent methane (CH_4). 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.

Providing natural gas to a city is an involved process and, as a result, most small- and medium-size cities rely upon others to assist them in the venture. 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 NYMEX as an energy commodity. Its price has been volatile since deregulation in the late 1980s.

TERMS AND DEFINITIONS

- **Backhaul:** A transportation term referring to natural gas purchased from a producer where the producer's point of entry into the interstate pipeline is geographically north or east of the

LDC's location. Normal natural gas flow in the interstate pipelines serving Tennessee is from the Gulf of Mexico area and from Oklahoma.

- **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, theoretically). Natural gas varies somewhat in heat content depending on origin.
- **Dekatherm:** The quantity of heat energy that is equivalent to 1 million British thermal units or 10 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. This will be for a specific time 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 capabilities included.
- **NYMEX:** New York Mercantile Exchange, a commodity futures exchange.
- **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 facility that purchases natural gas and transportation without using the LDC. 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 actually used. 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 given time 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 production well can be on dry land or on an elevated platform positioned in the ocean.

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. This is accomplished through the use of transportation contracts with the pipeline owner.

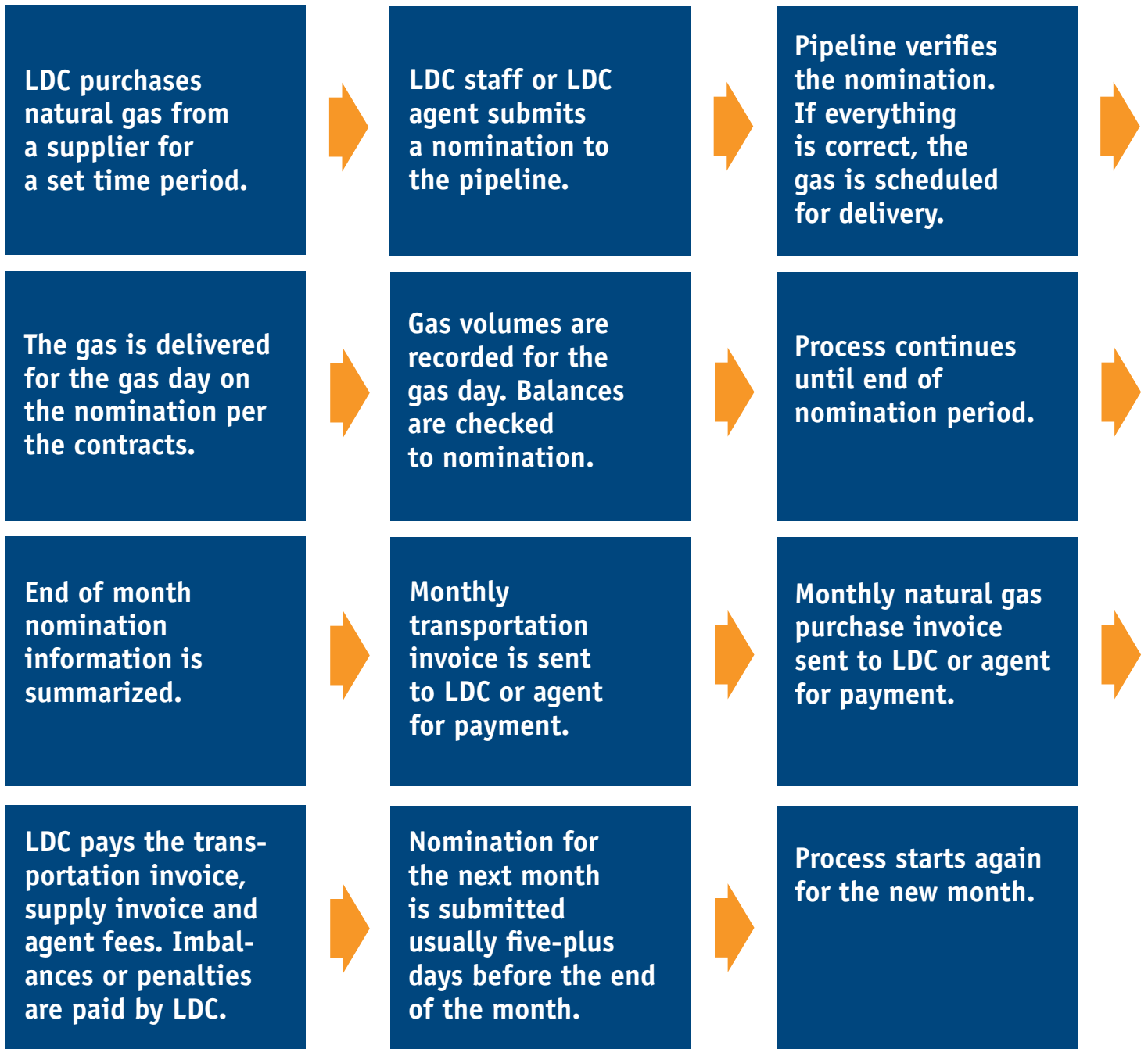
INTERSTATE PIPELINE

The LDC will have at least one transportation contract with an interstate pipeline. (There may also be a contract with an intrastate 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 in the late 1980s. 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, pipeline services and gas supply from the pipeline.

NATURAL GAS PROCESS





Agent

Most small to medium LDCs use an agent to manage their gas purchases, nominations, daily balancing, allocations 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 charges a monthly fee, which normally consists of a small fixed fee per month plus a cost per MMBtu purchased or managed for the month. This may be 2 cents to 10 cents or more per MMBtu, or it may be based on some other mechanism agreed upon in the agent/supplier contract.

The agent monitors the LDC's gas activities at the city gate, storage activities, storage amounts versus predicted levels for the gas year, contracts 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 act 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 work 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 Tennessee municipal gas system may choose a municipal energy acquisition corporation or a municipal gas authority for its gas supply and to act 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 farther the gas pumped from the supply the higher the percentage. In some cases it can exceed 10 percent.

Example

The LDC wants 100 MBtus 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 100 MMBtus to the city gate.

Transportation Contracts

Two types of transportation contracts used by municipal gas systems are firm transport contracts and no-notice transport contracts. There are other types of transportation contracts that a pipeline has available. An interruptible transportation 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 100 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 100 MMBtus to the city gate. The LDC used 100 MMBtus during the gas day and there is no imbalance.
- B. The LDC wants 100 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 100 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 100 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 100 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 set amount 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 100 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 100 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 100 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 100 may be nominated and 75 may come from storage. The LDC purchased 105 MMBtus, the



pipeline used 5 MMBtus for fuel, and the LDC had 100 MMBtus available at the city gate. The LDC used 165 MMBtus during the gas day. The nomination was 100, 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, a 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 if needed.

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 Regulatory Authority (<http://state.tn.us/tra/>) 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.

For More Information

The Tennessee Gas Association (<http://state.tn.us/tra/>) is a membership association of gas LDCs, suppliers, and others who work together in training and other natural gas issues.

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 100 MMBtu delivered at the gate station and used all 100 MMBtu for the gas day. The energy content was 1.032 MMBtu 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 100 MMBtus.

CONCERNS FOR ELECTED OFFICIALS

- **Maintaining adequate 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 for the time period.
- **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 handled in a 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.**



THE UNIVERSITY of TENNESSEE

MUNICIPAL TECHNICAL ADVISORY SERVICE

The University of Tennessee does not discriminate on the basis of race, sex, color, religion, national origin, age, disability, or veteran status in provision of educational programs and services or employment opportunities and benefits. This policy extends to both employment by and admission to the university.

The university does not discriminate on the basis of race, sex, or disability in its education programs and activities pursuant to the requirements of Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) of 1990.

Inquiries and charges of violation concerning Title VI, Title IX, Section 504, ADA or the Age Discrimination in Employment Act (ADEA) or any of the other above referenced policies should be directed to the Office of Equity and Diversity (OED), 1840 Melrose Avenue, Knoxville, TN 37996-3560, telephone (865) 974-2498 (V/TTY available) or 974-2440. Requests for accommodation of a disability should be directed to the ADA Coordinator at the UTK Office of Human Resources, 600 Henley Street, Knoxville, TN 37996-4125.