

Energy Security Planning

ENSURING NATURAL GAS CAPACITY TO MEET TENNESSEE'S ECONOMIC DEVELOPMENT NEEDS*

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March 29, 2022

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EXECUTIVE SUMMARY

Reliance on natural gas has grown significantly in Tennessee and it will remain a key component of the state's energy portfolio for the foreseeable future. Adequate and stable natural gas supplies, along with competitive prices and a safe system of distribution will be essential to the state's economic security and its future path of economic development. In other words, energy security will support economic security in Tennessee.

The **Tennessee State Energy Policy Council (SEPC)** has commissioned this report because of growing concerns about natural gas supply constraints that may hamper economic growth. The goal is to determine whether a comprehensive natural gas needs assessment is warranted. The findings below indicate that such an assessment is in fact warranted.

The research presented here is based on a review of publicly-available resources, a survey of local natural gas utilities and conversations with dozens of economic development practitioners and other stakeholders both inside and outside Tennessee.

The findings point to supply constraints in some areas of the state along with a series of other issues that should be evaluated in greater depth. Some of the problems, including pressure on the interstate system of natural gas distribution, are beyond the state's purview. Other problems are within the scope of state and local government responsibility, working in partnership with the private sector. A detailed list of findings and recommendations are presented at the end of this report. A concise summary follows.

- **Finding 1:** Capacity on the East Tennessee Natural Gas (ETNG) pipeline is fully subscribed. This constraint is binding and will limit future growth in the region served by ETNG. Spot constraints appear in other areas of the state. A comprehensive needs assessment encompassing the entire state (including west Tennessee) and a review of regulatory burdens associated with pipeline expansion is recommended to identify opportunities for increasing natural gas supplies to meet current and future needs.
- **Finding 2:** There are no apparent or widespread deficiencies in the integrity of the current pipeline capital stock. Available evidence suggests that the natural gas distribution system is safe. However, because pipeline safety data are not easily accessible, it is recommended that periodic safety reporting be made available to the public in an easily-accessible and user-friendly format.
- **Finding 3:** Prices tend to be higher in east Tennessee and show considerable variation across the state and by end-user class. A careful assessment of natural gas prices and price differentials for different regions and user classes is recommended to identify any impediments to economic development.
- **Finding 4:** A small number of local utilities and communities face unique natural gas supply constraints. Many rural communities in the state are underserved or unserved by natural gas; survey respondents raised concerns about the large number of small natural gas utilities and their structure and management. These issues should be explored to determine whether policy action is warranted.
- **Finding 5:** Natural gas use in the transportation sector is growing and is expected to grow further through fleet adoptions and as fueling capacity expands. There are few natural gas-refueling stations in the state today. Opportunities should be evaluated that could expand the number of facilities to support the movement of manufactured and agricultural products, including in rural areas of the state.
- **Finding 6:** Hard evidence on how natural gas supply constraints have affected business location, business expansion and economic development is currently limited. This is surprising based on evidence from pipeline companies and local natural gas utilities that have identified binding constraints on their supply capacity. State and local economic development officials should monitor business investment decisions and as problems arise work with communities and businesses to identify cost-effective solutions.

INTRODUCTION

The ongoing transition of global energy markets has led to a significant increase in Tennessee's reliance on natural gas for traditional applications like home heating, power generation and industrial production, as well as for more novel applications like fueling the transportation sector. Ongoing concerns over the use of coal and the lack of expansion of nuclear power capacity, coupled with relatively low prices and the ability of natural gas to meet baseload energy needs means that reliance on natural gas will remain relatively high for the foreseeable future.

Natural gas sourced from outside the state must move across an increasingly-congested network of interstate and intrastate pipelines to meet consumer needs.

Ensuring an adequate, stable, safe, and competitively priced supply of natural gas is essential to the state's energy security and its economic wellbeing. An important challenge is the fact that Tennessee is a significant net importer of natural gas. Natural gas sourced from outside the state must move across an increasingly-congested network of interstate and intrastate pipelines to meet consumer needs. Nationwide this system is being strained by the lack of new pipeline deployment and growing demand, including the need to move gas to support liquefied natural gas (LNG) exports.¹

This report is motivated by mounting concerns over the ability of natural gas supplies to meet the needs of the state both today and in the future. The intent is to identify potential current and future natural gas capacity constraints and any related problems that

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Concerns over natural gas availability and pricing are not new to Tennessee, the same issues arose in the early 1990s. At that time, emerging problems motivated an analysis that was supported by the state Department of Economic and Community Development, *Natural Gas Transportation Constraints in Tennessee*.² The key findings mirror concerns that have re-surfaced in recent years. As noted in the report's executive summary (page viii): *The natural gas capacity constraints confronting Tennessee are confined to (a) the unavailability of natural gas in many of the state's rural areas; (b) peak-load capacity problems in East Tennessee; and relatively high transportation tariffs in East Tennessee.* A series of incremental capacity expansions in ensuing years helped mitigate these problems. Bottlenecks are back and many rural areas continue to have limited or no access to natural gas.

The **Tennessee State Energy Policy Council (SEPC)** has initiated this inquiry to determine whether a comprehensive natural gas needs assessment is warranted. The SEPC is tasked with advising and making recommendations to the governor and general assembly regarding state energy policy. SEPC enabling legislation mandates the identification of state energy resources to ensure a secure, stable and more predictable energy supply and increasing energy exploration, development and production to promote economic

¹ The U.S. Energy Information Agency reports that pipeline capacity growth in 2021 was the lowest since 2016. Natural Gas Weekly, February 16, 2022. <https://www.eia.gov/naturalgas/weekly/>. The report notes that most of the new capacity was to support LNG exports. *Lack of Interstate Natural Gas Pipeline Capacity Threatens Manufacturing Operations, Investments, Jobs, and Supply Chain*, February 9, 2022. Communication from the Industrial

Energy Consumers of America to Congress. [02.09.22_NG-Pipeline-Capacity_FINAL.pdf \(ieca-us.com\)](https://www.ica-us.com/02.09.22_NG-Pipeline-Capacity_FINAL.pdf)

²Matthew N. Murray and David T. Mayes, *Natural Gas Transportation Constraints in Tennessee*, Center for Business and Economic Research, The University of Tennessee, Knoxville, August 3, 1995. Available at https://haslam.utk.edu/?haslam_whitepaper=natural-gas-transportation-constraints-in-tennessee

development while protecting the environment and the state's cultural heritage.³

The research presented here was built on a review of publicly-available resources and data, along with two surveys. The first survey relied on an online instrument distributed to local natural gas utilities through the Tennessee Gas Association (TGA). A second survey, conducted via phone and online platforms like Zoom, captured the views of economic development practitioners and other key stakeholders. The intent is to identify any natural gas supply, pricing and safety issues that may adversely affect the state and its economy.

The discussion below begins by providing background on the natural gas sector in Tennessee to help frame the problem. The focus then turns to the results of the online survey and interviews with experts. A detailed synopsis of findings and recommendations that is largely self-contained closes out the report.

Natural Gas Extraction and Use

In 2018, Tennessee and a set of 11 other states together held natural gas reserves of 94 billion cubic feet, or just 0.02 percent of total national natural gas reserves across the U.S.⁴ Currently there are only a handful of active natural gas wells in the state, there is little potential for extraction of natural gas from the state's shale reserves, and other sources like landfill gas will be in limited supply for the foreseeable future.⁵ Despite limited in-state extraction capacity, natural gas was the fourth largest source of energy used by the state in 2017, trailing (in order) petroleum, coal and nuclear.⁶ Tennessee is thus a significant net

importer of natural gas, relying on external markets and an interstate pipeline system that the state has no control over.

Importantly, 42.2 percent of natural gas was used in the state's industrial sector in 2017.⁷ Because Tennessee's manufactured products compete in a global marketplace, it is essential that in-state producers have access to an adequate, stable, and competitively priced supply of natural gas. The state's manufacturing sector accounted for 347,700 jobs across the state in 2021, or 11.3 percent of total employment.⁸ Many rural communities in Tennessee continue to rely heavily on the manufacturing sector as an economic driver.

Total energy use in Tennessee was up modestly at 4.4 percent between 2012 and 2017.⁹ In 2017, the state used a total of 331.7 trillion Btus of natural gas compared to 281.2 trillion Btus in 2012, reflecting an 18.0 percent increase in just five years. Importantly, the industrial use of natural gas climbed 30.6 percent over the same period of time.¹⁰ Natural gas used in the electric power sector was 32 times larger in 2019 compared to 2009. Natural gas used in the electric power sector jumped from under four percent of total gas consumption prior to 2010 to 30 percent in 2019.¹¹

Natural Gas Distribution System

A network of interstate and intrastate pipelines, many of which were built decades ago, connects natural gas supplies to end users. Historically most natural gas was sourced from the Gulf of Mexico. However, the origin shifted in 2015 and most natural gas now enters the state from the north.¹² Natural gas for in-state use moves across the

³ For background on the SEPC, including enabling legislation, see <https://comptroller.tn.gov/boards/sepc.html>

⁴ Matthew N. Murray, Charles B. Sims, Jilleah G. Welch and Simon Jolly, *An Assessment of the Energy Sector in Tennessee*. November 24, 2020. Howard H. Baker Center for Public Policy, page 25.

https://comptroller.tn.gov/content/dam/cot/energy-policy-council/documents/SEPC_2020_Assessment_Final.pdf

⁵ Matthew N. Murray, Charles B. Sims, Bruce Tonn, Jean Peretz, Jeff Wallace, Ryan Hansen and Lew Alvarado, *A Profile of the Energy Sector in Tennessee*. Howard H. Baker Jr. Center for Public Policy, the University of Tennessee.

<http://bakercenter.utk.edu/images/report13.pdf>

⁶ Murray et al., *An Assessment of the Energy Sector*, November 24, 2020, page 8.

⁷ Murray et al., *An Assessment of the Energy Sector*, Figure 2.1.

⁸ Lawrence M. Kessler, *An Economic Report to the Governor of the State of Tennessee*, Boyd Center for Business and Economic Research, the University of Tennessee, Appendix Table 8. <https://haslam.utk.edu/wp-content/uploads/2021/12/ERG2022.pdf>

⁹ *An Assessment of the Energy Sector*, 2020, page 7 and *A Profile of the Energy Sector*, 2014, page 43.

¹⁰ *An Assessment of the Energy Sector*, 2020, page 7 and *A Profile of the Energy Sector*, 2014, page 43.

¹¹ U.S. Energy Information Administration, *Tennessee State Profile and Energy Estimates*, July 15, 2021.

<http://www.eia.gov/state/analysis.php?sid=TN>

¹² U.S. Energy Information Administration, *Tennessee State Profile and Energy Estimates*, July 15, 2021.

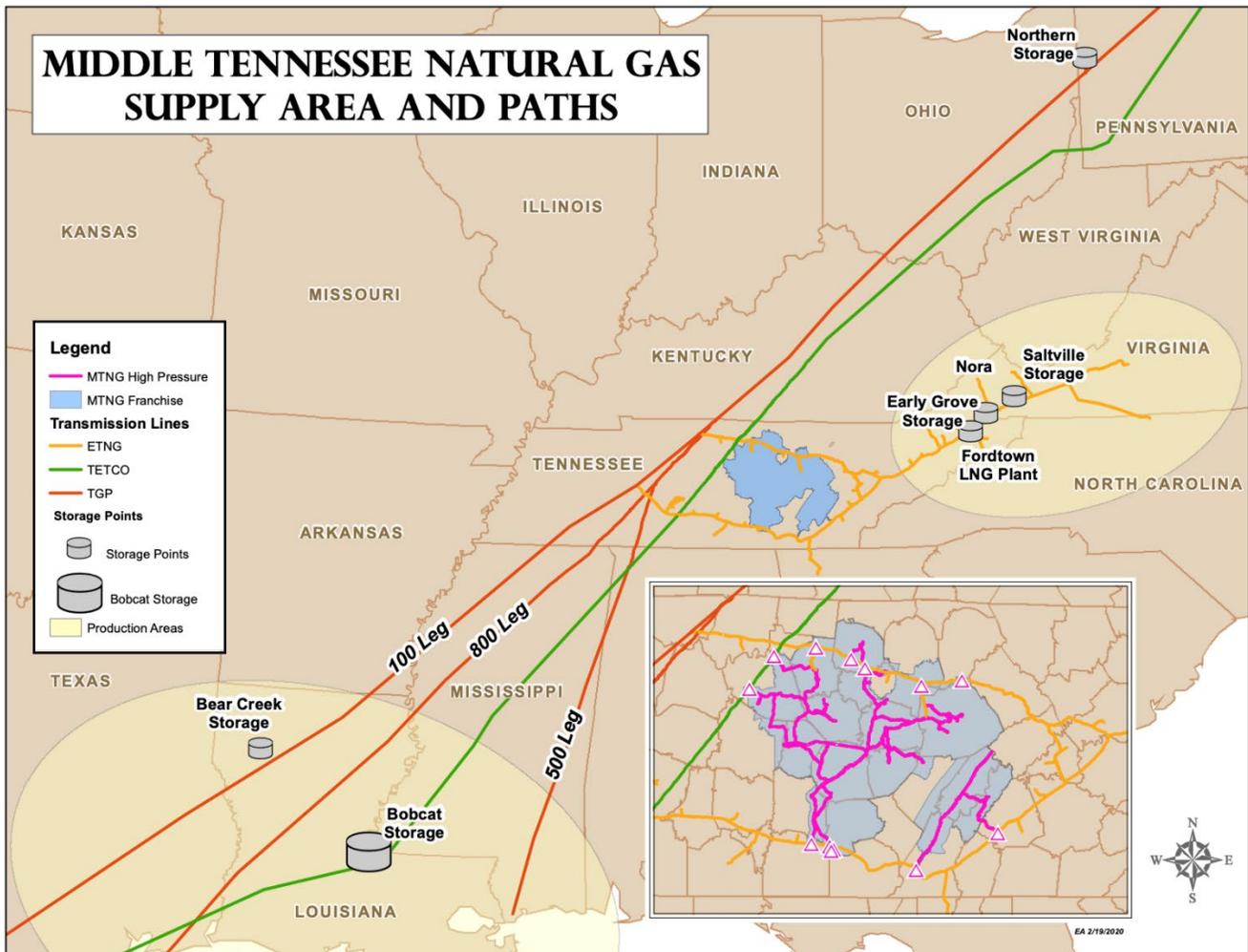
network to local natural gas distributors, including investor-owned utilities, municipal-owned gas systems and public utility districts. There are a number of large, directly-served industrial users of natural gas in Tennessee that purchase gas at wholesale and have it shipped directly for on-site use using the local distribution system.

Figure (1) provides a high-level perspective on the distribution system while Figure (2) highlights the interstate and intrastate pipeline network from middle to east Tennessee. The latter region of the state is highlighted because of the identified capacity constraints along the East Tennessee Natural Gas (ETNG) pipeline that are discussed more fully below. Several major interstate lines pass through middle Tennessee and

additional north-south interstate pipelines traverse the western portion of the state; these western lines do not have lateral connections to the system in middle and east Tennessee as is clear from Figure (1). The only major interstate pipeline in the east is Transco, located in North Carolina. There is an ETNG lateral connection to Transco coming from North Carolina into Virginia [(see Figure (2))]. Industry experts have identified Transco as capacity constrained.

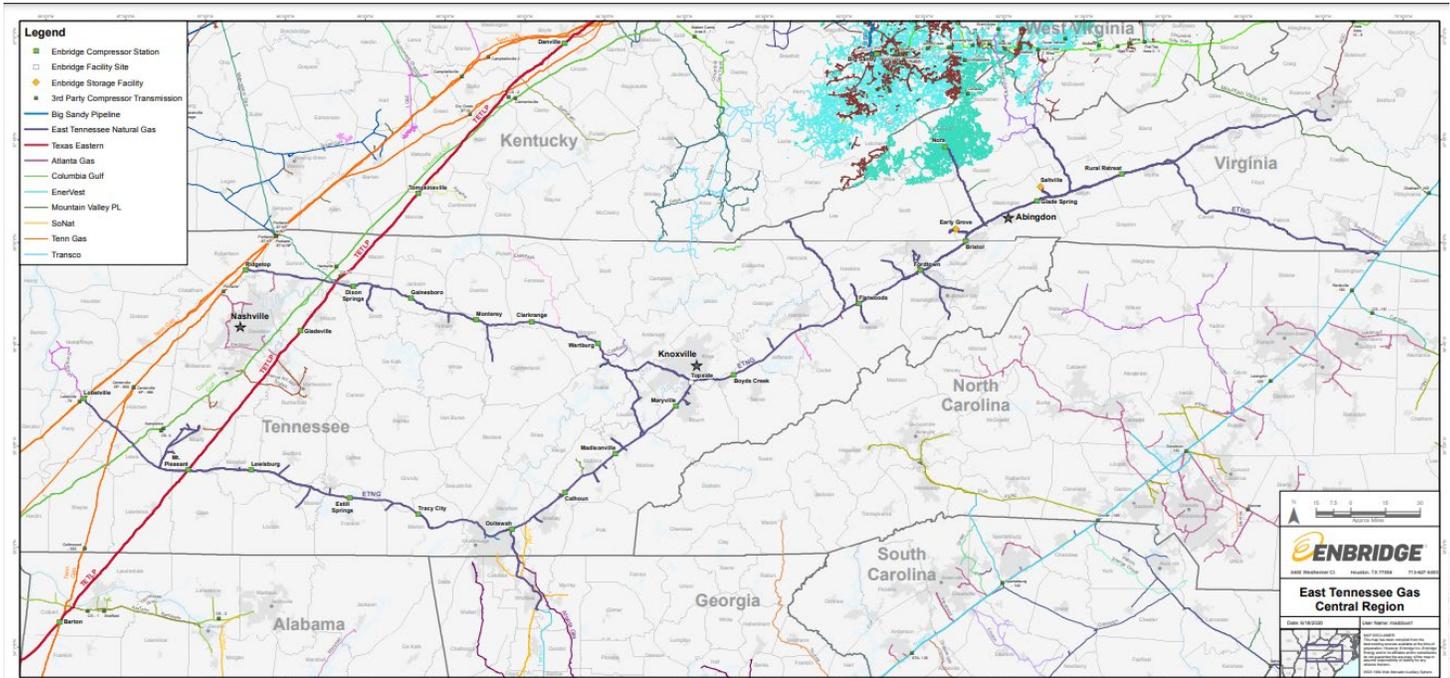
Despite the number of interstate pipelines crossing Tennessee, it is important to emphasize that these pipelines are all part of a national network. A substantial share of the natural gas that moves across the state is destined for consumption elsewhere and as such cannot be directly diverted for in-state use.

Figure (1) Interstate and Intrastate Pipeline Network from Middle to East Tennessee



Source: Courtesy of Middle Tennessee Natural Gas

Figure (2) Interstate and Intrastate Pipeline Network from Middle to East Tennessee



Source: Courtesy of Enbridge

The constraints along the ETNG pipeline arise because of its limited capacity to move gas through its own network. Safety oversight of the *interstate* natural gas network is provided by the federal Pipeline and Hazardous Materials Safety Administration (PHMSA), which is housed in the Department of Transportation.¹³ The Federal Energy Regulatory Commission (FERC) oversees facility construction, interstate commerce and “issuance of certificates of public convenience and necessity to prospective companies providing energy services...”¹⁴

The *intrastate* system of pipelines is subject to safety and pricing oversight by the Tennessee Public Utility Commission (PUC).¹⁵ Financial oversight, utility district commissioner training and

the creation/dissolution of natural gas (and other) public utility districts is under the purview of the Utility Management Review Board, housed in the Tennessee Comptroller of the Treasury.¹⁶ The Tennessee Association of Utility Districts also provides training and other support for utility districts, including those that provide natural gas.¹⁷

Prices

There is no single price of natural gas, but instead a range of prices that reveal the complexity of different facets of natural gas markets. The *wellhead price* is the wholesale price at the point of production and is determined by the traditional forces of supply and demand. The development of new production technology for shale gas formations

¹³ <https://www.phmsa.dot.gov/> Also see the Congressional Research Service report, “DOT’s Federal Pipeline Safety Program: Background and Key Issues for Congress,” March 29, 2019, <https://sgp.fas.org/crs/misc/R44201.pdf>

¹⁴ An overview of these and other FERC responsibilities can be found here [Natural Gas | Federal Energy Regulatory Commission \(ferc.gov\)](#)

¹⁵ <https://www.tn.gov/tpuc/divisions/gas-pipeline-safety-division.html> The Commission has limited oversight on prices, confined to eight intrastate pipeline companies.

<https://www.tn.gov/content/dam/tn/publicutility/documents/utilitydivdocs/ListofGasUtilities.pdf>

¹⁶ <https://comptroller.tn.gov/boards/utilities/utility-management-review-board.html#:~:text=The%20Utility%20Management%20Review%20Board,they%20are%20financially%20self%2Dsupporting,&text=The%20Board%20also%20establishes%20the%20parameters%20for%20water%20accountability.>

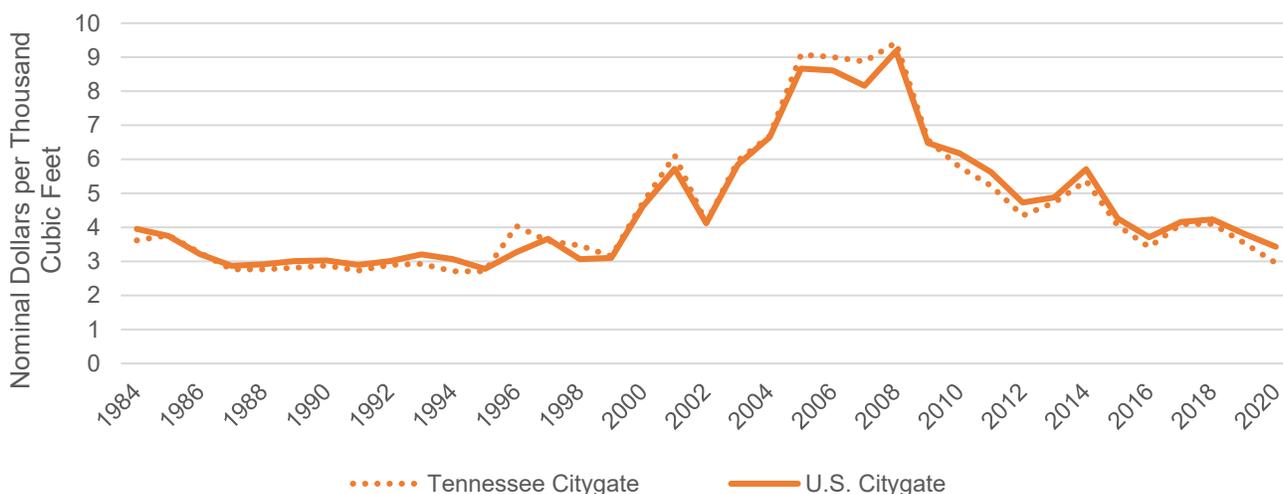
¹⁷ <https://taud.org/>

has increased supply in turn lowering its wellhead price. Subsequent strong growth in demand has put upward pressure on prices. Wellhead prices show variation across sourcing regions based on extraction costs and distance to final consumer markets.

The market price that is paid by local natural gas distributors for natural gas acquisition is referred to as the *citygate price*. This price includes the wholesale cost of natural gas and the *transportation fee* (tariff) that is charged by pipeline distributors for the movement of gas to the local utility distributor (i.e., the city gate). The transportation fees for wholesale gas distribution are generally distance-based.

All else the same, local utility markets that are further from the wholesale point of supply will generally bear higher transportation costs and thus higher citygate prices. Regions that have more interstate pipeline suppliers and capacity will tend to enjoy lower citygate prices because of greater competition over the wholesale commodity and associated transportation costs. Local natural gas distributors do not mark-up the wholesale price of gas to their consumers; their revenue is derived from a number of fixed and variable service fees that are independently charged for the retail distribution of natural gas in order to cover costs.

Figure (3) Average Citygate Prices for Tennessee and the U.S. (1984-2020)



Data Source: Price series data from U.S. Energy Information Administration (EIA).
https://www.eia.gov/dnav/ng/ng_pri_sum_dc_u_STN_m.htm

Average citygate prices for Tennessee and the U.S. are shown in Figure (3) for the period 1984 through 2020. The average price in Tennessee generally moves with the national price. This is to be expected since the wholesale price of the natural gas commodity is determined in a national marketplace. Since 2008, Tennessee has enjoyed a slightly lower citygate price than the national average. This may reflect the increased movement of natural gas from closer extraction fields in the Marcellus Shale region compared to gas sourced from the Gulf of Mexico.

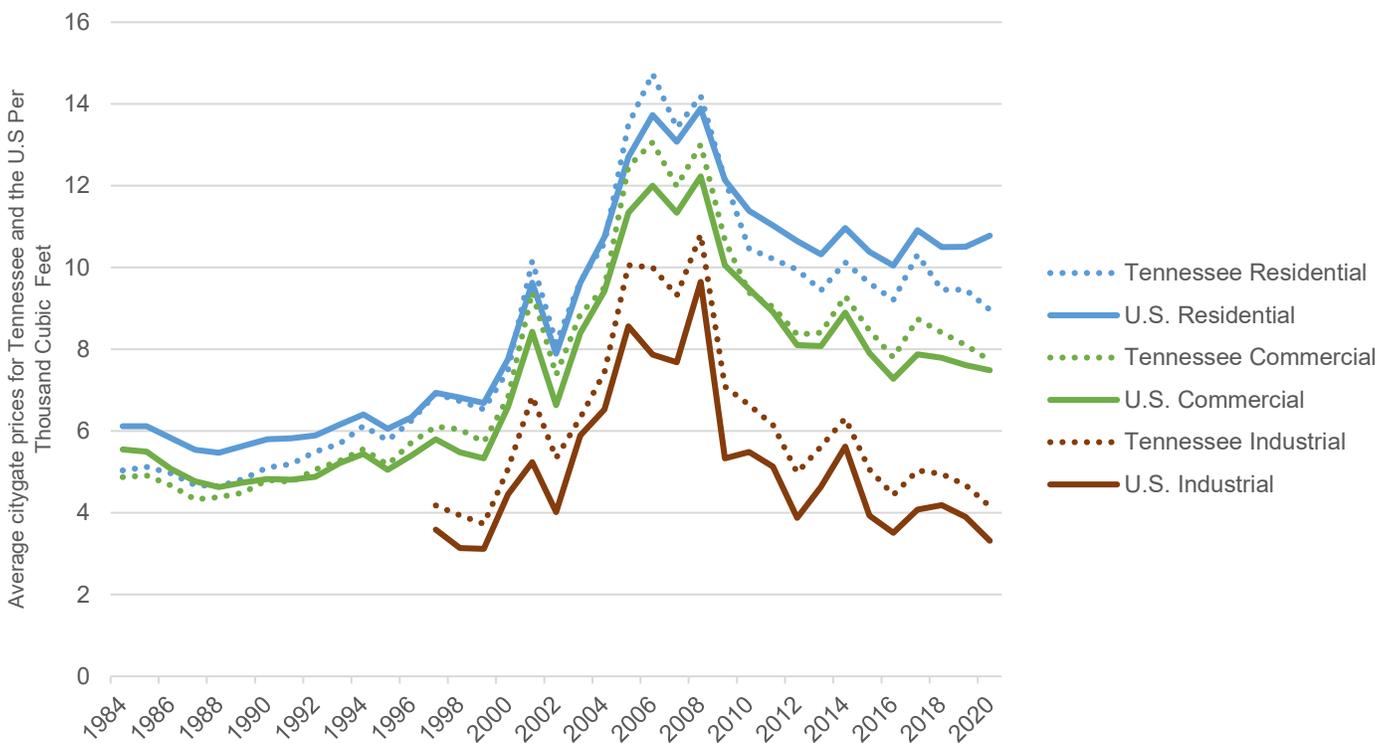
Figure (4) shows average natural gas prices for the same time period for different customer classes: residential, commercial and industrial. While all three prices in Tennessee and the U.S. move together over time like the overall average price, different customer classes pay systematically different prices. Residential customers pay the highest prices, with the price in Tennessee tending to be lower than its national counterpart. Tennessee commercial and industrial enterprises, on the other hand, pay higher prices in Tennessee than the U.S. These *cost-of-service* differentials in

prices reflect different costs of providing services to each user group.¹⁸

Different consumer classes may confront different rate structures rather than a single, uniform price. Residential consumers typically face a flat unit-volume price for the natural gas that is consumed regardless of the level of consumption. (Volume is generally measured in hundreds of cubic feet, i.e., CCFs or alternatively therms.) Commercial and industrial consumers, on the other hand, often confront sliding price scales depending on the volume of natural gas used, with price per unit

falling as consumption grows. These differences are intended to reflect the differential cost of service provision *within* each broad consumer class. Business consumers may confront additional demand charges that are fixed fees independent of the volume of gas consumed, as well as other charges. Rate and fee structures for businesses can be quite complicated in practice. An example that highlights some of the more salient factors that affect business prices is the rate structure charged by Middle Tennessee Natural Gas to “small industrial” users (referred to as Rate 36).

Figure (4) Average Natural Gas Prices for Tennessee and the U.S. by Customer (1984-2020)



Data Source: Price series data from U.S. Energy Information Administration (EIA).

https://www.eia.gov/dnav/ng/ng_pri_sum_dc_u STN m.html

Customers confront a \$16 monthly fixed fee, a rate of \$0.735 per therm of natural gas,¹⁹ a delayed payment charge of 5 percent, a turn on and/or reconnect fee of \$75. Larger industrial natural gas

users confront a different price structure (Rate 40): a \$60 per month customer charge, a rate of \$0.705 per therm²⁰ for the first 40,000 therms and \$0.565 per therm for additional therms, a 5 percent

¹⁸ Cost of service (or class cost) analysis is a component of overall utility rate design. Class-cost analysis seeks to allocate the costs associated with natural gas acquisition and its distribution to various consumer classes. For example, billing and metering costs may be allocated across consumer groups based on the number of consumers in each class. This

example helps illustrate why residential consumers face higher prices than other classes.

¹⁹ An additional *Purchased Gas Adjustment* also applies, which was \$0.220/therm in March, 2022.

²⁰ An additional *Purchased Gas Adjustment* again applies here.

delayed payment charge and a \$300 turn on/reconnect charge. Industrial consumers may see lower prices if they are willing to be subject to interruptible service (see Rate 50).²¹ Businesses with interruptible service must have alternative energy supplies to be able to sustain operations when gas supplies are curtailed.

Unfortunately, there is no single clearinghouse or source for local utility natural gas prices or rate structures. A cursory review of different utilities across the state shows that prices tend to be largely comparable, though there are exceptions. For example, the industrial rates charged by Cookeville utility are substantially higher than the rates charged by Middle Tennessee Natural Gas.²²

One explanation for the absence of comparable rate information is that there is no single body in Tennessee that provides consistent and systematic oversight of all natural gas utilities in the state. These responsibilities are spread across the Tennessee Public Utility Commission, the Utility Review Management Board and individual cities and counties that operate natural gas utilities.

²¹ <https://www.mtnng.com/rate-sheets/> For additional examples see <https://www.kub.org/bills-payments/understand-your-bill/business-rates/business-natural-gas-schedules/> and https://www.jaxenergy.com/images/uploads/resources/GAS_B.pdf

²² [Billing Rates | Cookeville, TN \(cookeville-tn.gov\)](#). The base rate is similar for the two utilities, indicating that that the cost of gas acquisition is higher for Cookeville than MTNG.

ONLINE SURVEY OF LOCAL NATURAL GAS DISTRIBUTORS

Local natural gas utilities are on the front line dealing with business and residential consumers at the local level across Tennessee. As buyers of wholesale gas and distributors of retail gas, these utilities understand how markets work, how prices are set and how the interstate and intrastate distribution system moves gas. Accordingly, they were the target of a dedicated online survey to ascertain any concerns regarding current and future natural gas availability, prices, system safety and system interruptions. The survey was developed with the support of SEPC members and in cooperation with the TGA which distributed the survey to its 93 members: TGA membership accounts for about 90 percent of all local gas distributors in the state. Distribution of the survey information was accompanied by a note from the SEPC member who serves as a natural gas representative to Council and a letter from the TGA President; multiple reminders were sent to the TGA membership urging them to complete the survey. A copy of the survey instrument is presented in the Appendix. Note that respondents were given the opportunity to explain their answers and offer open-ended responses and many chose to do so. Table (1) provides a list of utilities that responded to the survey.

Thirty-seven utilities responded to the survey for a response rate of 39.8 percent. While respondents come from across the state, most are in the western or eastern middle/eastern portion of the state. Table (2) summarizes the results of the survey.

Natural gas supply capacity. Nearly 25 percent of the respondents reported that they were not confident that they could meet the needs of their customers today. Several offered open-ended responses raising serious concerns about the ability to meet consumer demand in the future. Almost one in five (18.9 percent) indicated that they had turned a potential customer away because of current limits on supply. These are likely medium to large industrial firms that use significant volumes of natural gas. Potential natural gas customers often submit formal *Requests for Information* to local

Table (1) Local Natural Gas Utility Survey Respondents

GAS UTILITIES
Jefferson Cocke Utility District
City of Lafayette
Jackson Energy Authority
Unicoi County Gas Utility District
Middle Tennessee Natural Gas Utility District
City of Cookeville
Atmos Energy
Elk River Public Utility District
Hardeman-Fayette Utility District
City of Waynesboro
Corinth Gas & Water
Lake County Utility District
Dyersburg Gas System
Marion Gas
Pikeville Natural Gas
Citizens Gas Utility
City of Adamsville Utilities
Oak Ridge Utility District
Lexington Utilities
Brownsville Utilities
City of Lebanon Gas Dept
Lawrenceburg Utility Systems
Gibson County Utility
Sevier County Utility
West Tennessee Public Utility District
Knoxville Utilities Board
Etowah Utilities
Powell Valley Utility District Inc.
Collinwood Gas Dept
Navitas
Humphreys County Utility District
Fayetteville Public Utilities
Greater Dickson Gas Authority
Bolivar Utility
City of Munford
Powell Clinch Utility District

utilities to gauge supply availability and pricing structure. While just three of the respondents reported that they had chosen not to respond to such a request because of supply concerns, several others added comments that while they always responded to such requests, they are forced to reveal that they do not have the supply capacity to meet new user needs. Just 27.3 percent of those choosing to respond thought the supply situation would improve in the future.

Table (2) Local Natural Gas Utility Survey Responses

Question Prompt	Yes/Total Responses	Yes, % of Total Responses
Are you confident that your utility can meet capacity needs?	28/37	75.7%
Are there areas that are underserved due to pipeline constraints?	7/37	18.9%
If yes, do you expect this situation to change?	3/11	27.3%
For the transportation sector, are there areas that are underserved by natural gas refueling infrastructure?	23/37	62.2%
Do you expect this to change?	2/37	5.4%
Have you turned away a potential customer due to limits on natural gas supply?	7/37	18.9%
Have you ever declined to respond to an RFI?	3/37	8.1%
Are you paying higher prices due to a single pipeline supplier?	15/37	40.5%
Have you experienced any unplanned interruption in the last 10 years?	11/37	29.7%
Do you have customers that suffer from interruptions due to inadequate natural gas capacity?	8/37	21.6%
If not, do your customers still risk interruptions in the future due to capacity limits?	19/37	51.4%

Supply stability and interruptions. Utilities commonly offer interruptible service when supply is potentially subject to capacity constraints in exchange for lower rates. Eight of the utilities surveyed (21.6 percent) indicated that customers were subject to supply interruptions. Eleven of the respondents (29.7 percent) reported that they had experienced at least one unplanned interruption in the last ten years. Over half (51.4 percent) noted that customers were subject to future supply curtailments due to capacity limits. When asked whether the number of unplanned interruptions increased, decreased or stayed the same over the last ten years, eight indicated an increase, two indicated that they had stayed the same and one indicated a decrease in interruptions.

Natural gas prices. Fifteen of those surveyed (40.5 percent) indicated that they were paying higher prices due to being served by a single pipeline supplier. The small number of written responses show a wide divergence, with some utilities indicating that they paid competitive prices while others indicating that the price they paid was much higher than in other parts of the state. The price problem appears to be more serious for utilities on the ETNG system.

An open-ended question asked: How do natural gas prices for industrial, agricultural and transportation consumers compare to prices elsewhere in Tennessee and outside Tennessee? Most respondents indicated that they did not know or felt that rates were competitive. Thirty-six utilities responded to this question and only five shared any concerns about prices; three of the five indicated that high transportation charges associated with distance from source natural markets was the culprit. Note that pipeline expansion would not resolve the problem of distance to source.

Unfortunately, the responses to the two questions regarding prices do not offer clarity on the underlying sources of price variation. While it is likely that high prices are due in part to the constrained nature of the ETNG pipeline, other factors including the role of the other major interstate pipelines—like Transco which is supply constrained—may be part of the problem. Distance from source is also likely a contributing factor since it increases transportation costs to ship gas. The

nature of high prices is an important issue to understand since it has implications for economic development and the structure and level of prices following any major pipeline upgrades that might take place in the future.

Natural gas and vehicle refueling. Fuel diversification for the fleet of large and small vehicles is important in supporting competition and nurturing the deployment of new technologies. Tennessee has made great strides in promoting electrification opportunities that meet the needs of many consumer groups, including those who own light vehicles. Compressed natural gas (CNG) is growing in use especially by larger trucks because it is more efficient than electricity as a power source due to heavy battery banks. Note that in general natural gas is not directly used to fuel vehicles, it must be compressed first. The volume of natural gas used in the transportation sector is small today, but this is likely to change in the future, creating one more source of incremental pressure on natural gas supplies.

Because of the importance of natural gas for large truck use, one question asked about areas of the utility's service region that are underserved by natural gas refueling infrastructure. Twenty-three utilities (62.2 percent) said there were underserved areas; just two responded that they thought the situation would improve in the future.

ASSESSMENT BY EXPERTS AND STAKEHOLDERS

Thirty-four individuals representing a diverse set of experts and stakeholders were directly contacted and interviewed to assess their perceptions of the state of energy security in Tennessee, including the current and future adequacy of natural gas supplies, the competitiveness of natural gas prices, the safety of the distribution system and any related concerns regarding how natural gas markets may affect economic development.

One set of experts included economic development practitioners who are engaged in ongoing efforts to attract and retain industry in Tennessee, as well as more broadly promote economic development. Since these individuals work hand-in-hand with industrial targets, they should have a keen sense of the importance of natural gas as an input to production as well as its availability and cost at the local level across the state. A second set of experts included various stakeholders who represent broad interests in Tennessee, ranging from state agencies to statewide business associations.

A summary of contacts includes:

- Statewide and local economic development agencies, including the Tennessee Department of Economic and Community Development;
- Other state agencies including the Department of Transportation, Department of Environment and Conservation, Public Utility Commission, Department of Agriculture and Comptroller of the Treasury;
- Tennessee Valley Authority, natural gas pipeline companies and local natural gas distributors;
- Poultry industry; and
- University of Tennessee Institute of Agriculture and Institute of Public Service

Most of these conversations took place over the telephone or via an online platform like Zoom. Several members of the SEPC that represent important interests in the state also provided helpful feedback. In the narrative that follows, these views are summarized around the primary focus areas of this report.

Natural gas supply capacity. Industry experts indicate that while there is ample natural gas in the western portion of the state into middle Tennessee, the region covered by the ETNG pipeline is constrained and transportation services are fully subscribed. This means that there is no capacity to support significant new users, in particular large industrial enterprises. Some utilities in the eastern middle and east Tennessee region do not have capacity to meet incremental needs. One example is a large Tennessee Reservoir Development Agency (TRDA) industrial site that does not have access to gas; there is no immediate solution on the horizon. A small number of areas elsewhere in the state appear to suffer from supply constraints, those these tend to be in rural places where it may not prove cost-effective to extend pipelines.

Surprisingly, most regional economic development practitioners were unaware of this constraint on current and future economic development. Two experts affiliated with national site location firms that assist in industry location were also unaware of supply bottlenecks. It is possible that large industrial users of natural gas that are looking for sites have simply chosen to look elsewhere in the state or outside the state because of concerns over supply. Recall from the survey of natural gas utilities that supply constraints were commonly shared directly with potential new customers, possibly sidestepping any role by local economic development specialists.

There are a small number of large natural gas pipeline expansions planned in the state, but none of these are intended to alleviate near-to-long term constraints on supply. One is the Enbridge *Ridgeline Expansion Project* that will support conversion of TVA's Kingston steam plant, now reliant on coal, to natural gas. This line would be placed along the current right of way and run from near Hartsville to the plant. A proposed pipeline investment in middle Tennessee by Kinder Morgan, owner, and operator of the Tennessee Gas Pipeline, would serve the Cumberland power plant operated by TVA and yield no new capacity for other users.

A fundamental problem with pipeline expansions that add *new* capacity to the system is the FERC requirement that firm transportation subscriptions be in place to prior to construction. This is intended

to ensure cost recovery on investments prior to project approval and protect users from charges that would not otherwise be warranted. This is a classic chicken-egg problem—industry will not locate without natural gas supply, but pipelines cannot be extended without the demand for their services. Pipeline expansions are also costly and would likely lead to higher rates. Moreover, new investments are subject to substantial uncertainty that could delay or derail a project due to federal, state, and local regulatory hurdles and potential public opposition. To date, there is no evidence of a concerted, systematic push by natural gas users for capacity upgrades in the areas that are currently supply constrained.

Absent major pipeline expansion, there are few opportunities to ease supply constraints in the middle and eastern portions of the state. Additional efforts to promote conservation is one option but it is not clear if there is room for substantial gains on the part of various consumer groups that would do more than accommodate slow, marginal growth in utilization. Other options include shifting reliance to more-costly CNG and LNG. Related are *peak shaving* initiatives that gather gas in times of low utilization for use when demand is high, and when users confront substantially higher costs and/or bear the risk of interruption. Peak shaving systems require some form of storage, for example LNG or underground salt storage (which is not available in Tennessee).²³ These are all expensive alternatives to traditionally-piped natural gas, but they may have a place in meeting localized needs, potentially through partnerships across local distribution companies. The capacity of these systems is not likely sufficient to meet the needs of large natural gas users.

Renewable natural gas (RNG) surfaced in some conversations as a means of meeting multiple policy objectives: enhancing natural gas supply, promoting economic development, especially in

rural areas, and meeting environmental goals by promoting use of renewable carbon. RNG can come from a variety of sources, including agricultural waste, biomass, and landfills. Properly processed, it can be directly injected into the natural gas distribution system. A recent American Gas Foundation report indicates that high-end capacity for RNG in 2040 is about one-third of average U.S. consumption between 2009-2018.²⁴ There is a small number of RNG facilities in the state today and several are in the planning stages. While there is limited near-term capacity to have a meaningful impact on natural gas supply, the long term offers greater promise.

Safety of the distribution network. It is in the best interest of operators of the interstate, intrastate and local natural gas distribution network to maintain safety and system integrity to ensure gas flows and a financial return on investment. No one contacted in this assessment expressed concerns about the safety or integrity of pipeline network.

Enbridge is a large privately owned natural gas utility that provides interstate and intrastate pipeline distribution services in the U.S. Importantly, Enbridge owns the ETNG pipeline that serves portions of middle and east Tennessee. Their *East Tennessee Natural Gas System Alignment Program* is intended to support system safety and integrity but adds no new capacity to the distribution system. Of the four proposed investments, two would be in Tennessee, including 16.5 miles of new pipeline and a new compressor station; additional investments will take place in Virginia and North Carolina. These investments would require a FERC-approved rate increase.

Visualization data reported to the federal PHMSA indicate that the state is in the moderately low to low range for incidents involving interstate pipelines.²⁵ As noted above, the Tennessee PUC

²³ <https://www.ferc.gov/industries-data/natural-gas/overview/natural-gas-storage/natural-gas-storage-storage-fields>

²⁴ American Gas Foundation. Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment, December, 2019, page 17. <https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf> The U.S. Environmental Protection

Agency provides additional background and a mapping tool that allows identification of RNG sites.

²⁵ See <https://www.epa.gov/lmop/renewable-natural-gas>

²⁵ See https://www.npms.phmsa.dot.gov/Documents/NPMS_HeatMap_GTIncidents_wPoints.pdf It is not easy to find and extract incident data by state or pipeline.

has oversight of the *intrastate* pipeline system.²⁶ There appears to be no increase in incidents regarding intrastate pipelines within the state.

Natural gas prices. Very few concerns surfaced regarding natural gas prices in Tennessee, other than in the eastern portion of the state where supply is constrained. Capacity constraints and pricing on the Transco pipeline are perceived as contributing factors [See Figure (2) for the location of Transco].

Economic development consequences for industry, agriculture, and vehicle transportation. The modest concerns voiced above regarding supply and pricing translate into modest concerns regarding consequences for regional economic development. While the majority of those contacted held this view, there were significant exceptions indicating that the problem was real today and would only get worse as incremental demand growth puts greater pressure on supply capacity. A small number of utilities and economic development practitioners were very concerned, noting that there is insufficient pipeline capacity to support *any* new major industrial firm or other user in east Tennessee in particular. For example, officials with Loudon County noted that they did not have adequate natural gas to support a Tellico Reservoir Development Agency (TRDA) megasite.

Additional concerns came from the poultry industry which relies heavily on natural gas for heating chicken brooders. The poultry industry suffers in particular because brooder facilities are located in rural portions of the state which are often unserved or underserved. The only practical alternative to natural gas is propane which is more costly. In principle propane can be used as a substitute for natural gas, but the two fuels require different burners and other components, so they do not serve as perfect substitutes. It is not clear how other agricultural, or business sectors may be adversely affected by current and looming supply constraints and pricing practices.

The various economic development challenges call for potentially different policy approaches, not all of which would prove to be cost effective. For example, it is probably not cost effective to run high-capacity natural gas pipelines to every industrial park in the state, just like it is not cost effective to connect every city in the state with a major four-lane highway.

Natural gas and vehicle refueling. Only a small number of individuals raised issues regarding vehicle transportation and the dearth of natural gas refueling stations in the state. When prompted, most could not identify the location of the nearest refueling facility. There was an awareness that this issue is potentially important for the future as alternative fuels for large trucks in particular become more common. Large trucks help support the state's focus on manufacturing and wholesaling, as well as the movement of bulky agricultural products. Rural places in Tennessee may be at a special disadvantage since they don't have the same concentration of potential natural gas users as urban places and interstate corridors. It was noted that major fleet adoptions would be a critical step in fostering the spread of refueling facilities.

Natural gas utility structure and management. The intent of this report is to identify potential problems related to natural gas supply, pricing, and pipeline safety in Tennessee. So, it was rather surprising to find a significant number of contacts voice often unsolicited concerns regarding what might be called the *structure and management* of local natural gas utilities.²⁷ Specific issues raised included the proliferation of small gas utilities, poor management practices, lack of transparency, myopic investment practices and absence of consistent oversight by the state over independent, county and city gas utilities. It is not clear how pervasive these problems are. As drafts of this report were reviewed by external experts, some indicated that these were isolated, localized problems.

²⁶ <https://www.tn.gov/tpuc.html> The annual report provides a brief overview of the Gas Pipeline Safety Division <https://www.tn.gov/content/dam/tn/publicutility/documents/reports/anlrpt1920.pdf>

²⁷ Several contacts indicated that similar problems arise in water and electricity utilities, though that was not explored here.

Some of those who were surveyed called for “regionalization” of natural gas utilities whereby smaller independent utilities would be restructured and consolidated with other natural gas utilities to promote economies of scale in service delivery, create greater access to a pool of professional managers and improve customer service. This issue should be studied carefully and comprehensively before significant policy action is taken. To the extent that problems are identified, policymakers in Tennessee, including members of the general assembly and local elected officials, should be informed.²⁸

A small number of contacts noted the disparate oversight of private natural gas utilities by the state’s PUC and Comptroller and the reliance on public oversight through the ballot box for municipal natural gas utilities. Natural gas utilities are generally granted a monopoly franchise within their service delivery area. As state-sanctioned monopolies that serve the public interest, they should be carefully, consistently and uniformly regulated by the state and/or local governments.

²⁸ One response to a specific concern regarding financial management is HB1713 and SB1812 which focuses on utility district merger or consolidation and creates a fund to address the financial consequences of combining utilities. <https://trackbill.com/bill/tennessee-house-bill-1713-utilities-utility-districts-as-introduced-changes-the-process-by-which->

[the-utility-management-review-board-may-address-financially-distressed-utility-districts-by-merger-or-consolidation-creates-a-fund-administered-by-the-board-to-provide-grants-to-utility-districts-that-have-merged-or-consolidated-to-mitigate-the-financial-impact-of-the-merger-or-consolidation-amends-tca-title-7-chapter-82-part-7/2186768/](https://trackbill.com/bill/tennessee-house-bill-1713-utilities-utility-districts-as-introduced-changes-the-process-by-which-)

KEY FINDINGS AND RECOMMENDATIONS

As noted in the body of the report, the U.S. EIA shows that natural gas use in Tennessee has been rising much more rapidly than overall energy use, with especially strong growth taking place to support expanded centralized power generation and industrial applications. Increased utilization of natural gas has taken place because of relatively attractive prices and a smaller environmental footprint compared to coal. The pervasive use of natural gas and the deep investments that have been made to deploy it means that it will continue to be an essential element of the state's overall energy portfolio for the foreseeable future. As demand continues to grow, the state's economic prospects will hinge on adequate and stable supplies of natural gas, a safe system of distribution and competitive prices for end users. Energy security is essential to the state's economic viability.

The evidence presented here indicates that concerns are growing regarding the capacity of the interstate and intrastate pipeline distribution system that serves the state to meet its needs, especially in the region served by the ETNG pipeline. As supply constraints become more binding, prices will likely rise, interruptions will likely become more common and end users will be driven toward other more expensive and less environmentally-friendly sources of energy. The concerns that have arisen are similar to those that surfaced in the mid-1990s when supplies were sharply constrained. In subsequent years, supply capacity was increased to meet user needs. However, the ongoing growth in the demand for natural gas has once again placed pressures on the distribution network. Complicating the problem has been the dramatic growth in liquefied natural gas (LNG), much of which now goes to export markets.²⁹ This has added stress to the current system of distribution.

The discussion that follows summarizes key findings regarding the ability of the natural gas distribution system to meet the growing need for

natural gas in the state to support economic development. The emphasis falls on industrial and agricultural uses of natural gas since these are job creation sectors for the state. However, the findings apply generally to other end-user groups, including residential, commercial and transportation. The recommendations below generally call for additional research that can more deeply inform stakeholders and produce concrete, cost-effective policy initiatives to ensure natural gas can support the state's future growth. *A comprehensive natural gas needs assessment should address all of these issues.*

Finding 1: Capacity on the East Tennessee Natural Gas (ETNG) pipeline is fully subscribed.

Based on conversations with the pipeline parent company (Enbridge) and local natural gas distribution companies, the ETNG pipeline transportation service is fully subscribed to existing users. This applies generally to ETNG's coverage area from near middle Tennessee through the eastern portion of the state. A survey of local natural gas distributors, which was administered in cooperation with the Tennessee Gas Association, indicated that about one-fourth were currently supply constrained, most of which were located in east Tennessee. This constraint on supply will sharply curtail the potential for new growth including the siting of large industrial facilities that rely heavily on natural gas for their production processes. Local natural gas distributors in middle Tennessee have also expressed concerns about the capacity of the pipeline system to meet future needs, though there are few imminent bottlenecks.

A new intrastate pipeline has been proposed by Enbridge (the *Ridgeline Expansion Project*) that would run from near Hartsville in middle Tennessee to Kingston in the eastern part of the state. However, this line is intended to support the possible conversion of TVA's Kingston steam plant to natural gas and will not offer additional capacity for other users. At this time, no firm decision has

²⁹ The U.S. will have the largest global LNG export capacity in 2022.

https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2021/12_02/

been made regarding moving forward with the project.

A serious problem associated generally with pipeline expansion is the requirement of the Federal Energy Regulatory Commission (FERC) that natural gas subscriptions be in place prior to pipeline approval and construction. While well intended, this policy does slow new pipeline construction. The only practical remedy for the state is to make a concerted effort, in cooperation with users and private industry, to ensure subscriptions are viable and in place.

Recommendations:

- To ensure the state's energy and economic security, conduct a comprehensive needs assessment that would consider current and future natural gas needs for all user categories (residential, industrial, commercial, agriculture and transportation) and the capacity of the interstate and intrastate pipeline network in Tennessee to meet these needs. This includes the western part of the state which today does not suffer from constraints but may in the future.
- Evaluate the potential for a consortium of local natural gas utilities and heavy industrial users in east Tennessee to provide the required *firm* subscription of natural gas through the pipeline system (i.e., transportation services) that may warrant pipeline development. Consider short-term state financial guarantees on subscriptions to help eliminate uncertainty.
- Support stopgap and bridge measures that can sustain the availability of natural gas supplies in the near to mid-term, especially in localized areas where supply is already tight. Since it would take approximately 4-5 years from inception to complete a major pipeline expansion, it is important that steps be taken now to mitigate possible future constraints. Options include additional pipeline interconnects, pipeline, and compressor upgrades (see below), peak shaving facilities that capture and store gas when demand is low for use when demand is high, and LNG and other forms of storage. Some of these options are expensive and may not prove cost effective.
- Consider the role of renewable natural gas (RNG) in providing small but potentially important

incremental supplies and offering a possible economic development opportunity for rural areas of the state. Tennessee has very limited natural gas supply capacity from traditional wells. However, RNG is already being exploited in a variety of ways in Tennessee, including drawing from landfills and agricultural waste. Clean RNG can be directly injected into the natural gas distribution system for use by traditional users. While RNG is relatively expensive compared to traditional natural gas, federal greenhouse gas credits are available that reduce their effective cost to buyers. Even at higher prices, RNG can be attractive as a means of meeting environmental objectives, whether mandated (e.g., by a state renewable energy portfolio) or voluntary (e.g., by a company seeking to reduce its environmental footprint). Credit for using RNG may accrue even if the buyer does not directly use the RNG.

- Evaluate state and local regulatory and compliance burdens associated with pipeline construction and improvements, including time costs which raise project costs and uncertainty. Compliance burdens should be balanced against environmental objectives and economic development needs.
- Promote energy conservation initiatives that lead to reductions in natural gas use to free up capacity for other users on the network.

Finding 2: There are no apparent or widespread deficiencies in the integrity of the current pipeline capital stock.

Pipeline system integrity is essential to the state's economic security. End users and local distribution companies do not face systemic supply curtailments because of network failure. (Some businesses subscribe to *interruptible service* and face supply constraints when demand is high; these firms enjoy lower prices in exchange for service that is interrupted when demand approaches peak.) The Tennessee Public Utility Commission has safety oversight over intrastate pipeline facilities and notes no increase in breakdowns or failures. The Pipeline and Hazardous Materials Safety Administration (PHMSA), a division of the U.S.

Department of Transportation, has oversight of interstate pipelines. Incident data for Tennessee tends to be moderately low to low, using PHMSA's five-point scale. It is in the best interest of pipeline operators to maintain the quality of their investments. Importantly, Enbridge has expressed interest in a possible FERC filing to raise rates to fund capital stock upgrades to maintain safety and viable gas flows, the *East Tennessee Natural Gas System Alignment Program*. In Tennessee, the project includes 16.5 miles of new pipeline and a new compressor station; additional investments are proposed for Virginia and North Carolina. The project would not create additional capacity for the transportation of gas.

Recommendations:

- Policymakers, local utilities, and end users should take a close look at the Enbridge Alignment Program that is intended to ensure capital stock integrity and energy security in east Tennessee and determine if their support is warranted. Should the proposal move forward, some will be opposed because the higher rates may not directly translate into obvious and visible improvements in service.
- Support periodic reporting to the public at large, policymakers and end-users that would document pipeline safety and integrity. While safety and related data are available for interstate and intrastate pipelines from the PHMSA, they are not systematically gathered and interpreted for easy access by the general public and other stakeholders.

Finding 3: Prices tend to be higher in east Tennessee and show considerable variation across the state and by end-user class.

Average natural gas prices in Tennessee tend to track the U.S. national average based on data from the U.S. EIA. However, prices are higher in east Tennessee because of distance from source wells, the need for some to reserve capacity on multiple pipelines (*demand charges*) and capacity constrained pipelines. Almost one-half of the local natural gas distributor survey respondents indicated

that prices were too high. A spot check of local distributor prices shows significant variation across the state and across end-user classes. High natural gas prices can hamper economic development while price differentials can distort the location of economic activity across the state.

Recommendations:

- Conduct a careful and systematic review of wholesale and retail natural gas prices across Tennessee to isolate the underlying factors that lead to price differentials for firm and interruptible service, including commodity charges, demand charges and other surcharges and fees. Special scrutiny should be applied to rural Tennessee where distribution capacity is more sharply constrained.
- Evaluate end-user price differentials for different user groups, especially heavy industry, and agricultural sectors like poultry, both of which are major users of natural gas. Conduct a *hypothetical firm simulation analysis* that allows for the analysis of natural gas cost differentials based on different profiles of end users (e.g., large versus small industry) and different facets of natural gas supply (e.g., firm versus interruptible service, single versus multiple interstate pipeline suppliers). Identify factors that may lead to significant price and costs differentials that may affect economic development.

Finding 4: A small number of local utilities and communities face unique natural gas supply constraints.

Some places in Tennessee, especially rural communities, have areas that are unserved or underserved by natural gas. This includes natural gas for residential, commercial and transportation use but also industrial parks and certain agricultural applications. A primary challenge is the high cost of running pipelines to small numbers of users spread over a large geographical area. Separate are concerns over management and financial planning practices, as well as the perceived lack of a willingness to finance local pipeline expansion projects to the detriment of potential local users. There are large numbers of local utilities across the

state, and some may not have the independent management capacity to effectively meet community needs.

Recommendations:

- Assess the unique challenges confronting small communities and local utilities as they seek to provide natural gas services, recognizing that it may not be cost effective to expand capacity in every corner of the state. Evaluate efforts to mitigate supply gaps, including state grants and/or loans for capacity expansion, especially where expansion can promote economic development through job creation. Consider the possible role for RNG in helping to meet localized supply gaps.
- Conduct an assessment of local utility structure, management practices and related activities like financial planning, capital budgeting and wholesale gas acquisition and make recommendations on best practice. The Utility Management Review Board in the Comptroller's Office provides financial oversight of all utility districts in the state; additional oversight is provided for utilities not aligned directly with local governments, including the provision of much needed management training which is mandatory for utility district board members. A review of these practices would be beneficial to ensure that they are comprehensive, well-coordinated and meet the needs of their community.
- Evaluate the potential for local natural utility merger or consolidation to promote economies of scale and encourage cost-effective capacity expansions. HB1713 and SB1812, introduced in the current session of the general assembly, is one strategy. The bill addresses financially strapped utilities and creates a fund to defer costs associated with absorbing a financially distressed district.

Finding 5: Natural gas use in the transportation sector is growing and is expected to grow further through fleet adoptions and as fueling capacity expands.

Electrification is not a practical strategy for large trucks due in part to the heavy weight of battery banks. CNG, on the other hand, is increasingly being adopted for use in large trucks, including the UPS fleet. Supporting large truck fueling diversification is important to promote fuel competition. It is also important because of the state's reliance on manufacturing, wholesaling and agriculture for job creation and the need to export final products beyond the state's borders. There is only a limited number of CNG fueling stations in Tennessee today. Two-thirds of the respondents to the survey of local natural gas distributors indicated that their area was currently either unserved or underserved by CNG stations and most see no change on the horizon.

Recommendations:

- Continue ongoing state support and partnerships for transportation fuel diversification to promote fuel availability, price competition and end-user needs.
- Evaluate the potentially unique needs and circumstances of rural communities to support agriculture and industry through CNG refueling capacity.

Finding 6: Hard evidence on how natural gas supply constraints have affected business location, business expansion and economic development is currently limited.

While there are a small number of exceptions, economic development practitioners across Tennessee are largely unaware of any natural gas supply bottlenecks in the state; existing industry has largely been silent about natural gas prices and availability. Contacts with two experts affiliated with national site selection firms also produced no evidence of concerns regarding natural gas availability in the state, including east Tennessee. One explanation for the absence of concerns is that existing industry is currently subscribed to natural gas services, including many large industrials that are directly served by pipeline transporters. Local distribution companies, on the other hand, are directly dealing with potential customers and clearly

aware of the problem and concerned about the future. The survey of local natural gas distributors indicated that almost one-fourth had to turn industrial customers away because of supply shortfalls. A small number have declined to respond to requests for information from industry about supply availability; many others have reported that they have little or no additional capacity.

Recommendation:

- The Tennessee Department of Economic and Community Development should work with TVA's economic development team and local economic development agencies to monitor business perceptions regarding natural gas supply capacity and prices across the state. As problems arise, efforts should be made to identify business-friendly and cost-effective mitigation strategies in partnership with local utilities.

APPENDIX

Tennessee State Energy Policy Council: Energy Security Planning in Tennessee

Local Natural Gas Utilities Survey

Q1: What is the name of your utility?

Q2: What current natural gas pipeline(s) are supplying your utility?

Q3: Do you feel confident that your utility can meet the natural gas capacity needs of industry and agriculture *today*? [Yes, No]

Q4: Please explain.

Q5: Are there significant areas of your service area that are currently underserved or unserved because of natural gas supply constraints from the pipeline that serves your utility? [Yes, No]

Q6: Please explain

Q7: If yes, do you expect this situation to change in the foreseeable future? [Yes, No, N/A]

Q8: For the transportation sector specifically, are there significant areas of your region that are underserved or unserved by natural gas refueling infrastructure (e.g., compressed natural gas refueling stations for vehicle purposes)? [Yes, No]

Q9: Please explain

Q10: Do you expect this situation to change in the foreseeable future? [Yes, No]

Q11: Have you ever had to turn away a potential industrial, agricultural, or transportation customer because of limits on the natural gas supply to your distribution system? [Yes, No]

Q12: Please explain.

Q13: Have you ever declined to respond to a RFI (Request For Information) from a potential industrial, agricultural, or fleet customer, developer, or chamber of commerce contact because of inadequate gas supply volumes? [Yes, No]

Q14: Please explain.

Q15: Are you paying higher prices because your system is only supplied by a *single* pipeline? [Yes, No]

Q16: Please explain.

Q17: How do natural gas prices for industrial, agricultural, and transportation consumers compare to prices elsewhere in TN and outside TN?

Q18: Have you experienced any unplanned interruption of service from the pipeline serving your

Q19: If the answer is yes, has the number of unplanned interruptions increased, decreased, or stayed the same over the last ten years? [Increased, Decreased, Stayed the same, N/A]

Q20: Do you have any industrial, agricultural, or fleet customers that suffer from interruptions to service due to inadequate natural gas capacity? [Yes, No]

Q21: Please explain.

Q22: If interruptions to service have *not* taken place, do your customers still bear the risk of interruptions to service in the future because of capacity limitations? [Yes, No]

Q23: Please provide any additional information regarding the capacity to meet the natural gas needs of your community. If natural gas capacity in your community is constrained, do you have any recommendations for alleviating this problem?