



Introduction

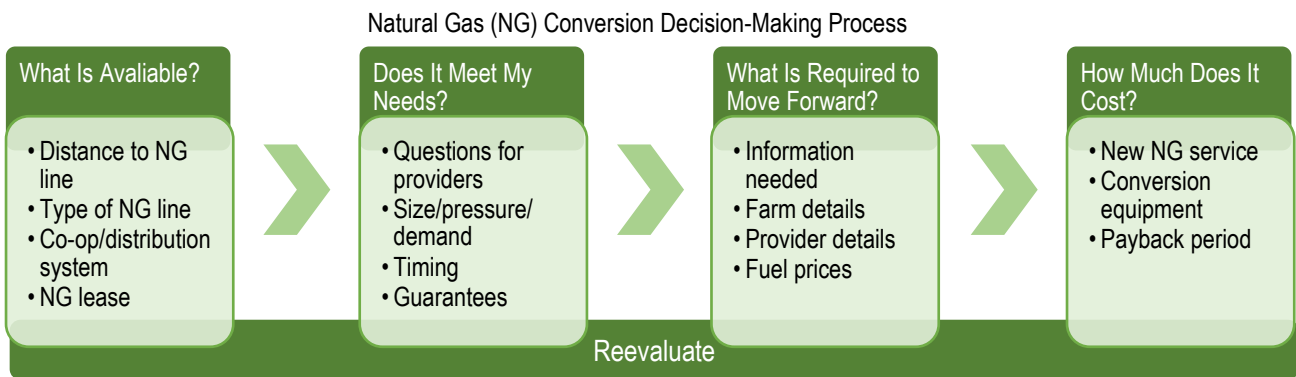
The Ohio Soybean Council (OSC) established the Natural Gas Conversion Technical Assistance Project to provide guidance to Ohio soybean farmers in converting farm operations from propane to natural gas use. During this project, OSC advised and gathered the experiences of Ohio soybean farmers on the options, possibilities, and steps in the natural gas conversion process. The lessons learned from this project will be used to support further assistance to Ohio soybean farmers interested in natural gas conversion.

Four Major Questions for Natural Gas Conversion

When considering options for converting propane use on the farm to natural gas, four major questions outline the decision-making process:

1. **What is available** (including nearby natural gas sources)?
2. **Does it meet my needs** (including the farm’s natural gas demand and the timing of a natural gas project)?
3. **What is required to move forward** (including information needed to make decisions)?
4. **How much does it cost** (including installing the new natural gas service and making the conversion)?

Farmers can decide whether to proceed with the conversion process as these questions are answered. As situations and answers to these questions change (e.g., if a new natural gas cooperative expands in the area, or if the price of propane is expected to increase dramatically), farmers can reevaluate their decisions.



About this Document

This document is intended for those who are interested in natural gas conversion but have not yet decided to move forward. It provides a general process and general steps to support farmer decisions regarding natural gas conversion. With this document, OSC aims to distill a complex issue into clear categories of decision points so that farmers can make informed decisions about converting their farm operations to natural gas. Appendices—including a checklist of questions to ask, a worksheet to keep track of information, and additional helpful resources—are included in this document to further assist farmers with their decisions.

To develop this document, OSC collaborated with three farmers of varying farm size, location, and operations to understand their situations relevant to exploring natural gas options, provide technical assistance on the conversion process, and gather lessons learned that may relate to other Ohio soybean farms. Variances in farm characteristics of participating farms related to the known natural gas availability in the area, types of natural gas companies present, distances to known existing natural gas lines, and past discussions with natural gas providers:

- **Natural gas availability** included gathering, transmission, and local distribution pipelines.

- **Distances to known natural gas lines** ranged from approximately 250 feet to 2 miles.
- **Natural gas companies** included transmission pipeline, local service provider, and natural gas installation companies.
- **Past discussions with natural gas service providers** over the last several years ranged from advanced stages of discussing a potential project, to some discussions with little progress, to very little contact.

All of the farmers typically purchase bulk propane for farm use and were interested in converting their existing propane equipment to operate with natural gas, while maintaining propane as a backup fuel source.

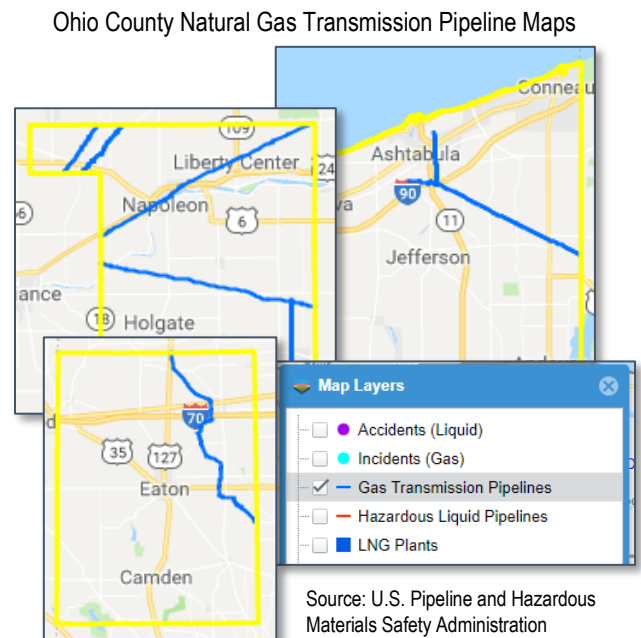
What Natural Gas Infrastructure is Available?

A key first step in the decision process for natural gas conversion is understanding what natural gas infrastructure is available to the farm.

Natural Gas Source Type

The type of natural gas pipeline available determines what type of service line can be installed. The size, pressure, and load capacity of the pipeline in question determine the feasibility of establishing a new service line to the farm (the pipeline must be able to support the additional load that the farm would draw in natural gas use). Common options available to farmers include leveraging existing service to the farm, connecting to a local distribution system—such as a local natural gas utility or cooperative (co-op)—or connecting to a large transmission pipeline. Local distribution systems are more likely to accept new customers for service. Natural gas co-op service providers are often looking to expand their customer base and service area, even seeking out farms with grain drying operations for new service.

Installing new service from a large transmission pipeline—sometimes referred to as a “farm tap”—is typically much more expensive, and the companies involved may be less willing to provide service to individual customers. However, if a transmission pipeline is nearby, it may be worthwhile to investigate the option of a farm tap. The collection of images on the right shows examples of county maps that are available from the U.S. Pipeline and Hazardous Materials Safety Administration to locate natural gas transmission lines (see Appendix C).



More information on who to contact regarding natural gas pipeline types is included in the “Does it Meet My Needs?” section below.

Distance from Farm to Natural Gas Source

The distance from the farm to the available natural gas source is a major driving factor in deciding whether to pursue natural gas conversion. Typically, this distance is the primary influencer of the overall cost for a potential natural gas conversion project. Logically, labor and materials increase as the distance lengthens. Often, company quotes for completing a new service project will be given in dollars per foot of distance. Comparing the distance and cost per foot with the expected savings in annual fuel cost (natural gas versus propane) allows for an estimated payback period. Different companies may offer different prices, so farmers should obtain multiple quotes, if possible. More information on costs and payback period is included in the “How Much Does It Cost?” section below.

Natural Gas Extraction

The proximity of natural gas extraction may be a consideration for some farms. With the recent expansion of natural gas extraction across Ohio, opportunities may exist (through natural gas leases or other agreements) for farms to connect directly to natural gas wells. Farms with active natural gas extraction or leases for extraction nearby could acquire comparatively inexpensive natural gas directly from the point of extraction, rather than through multiple intermediary companies. However, obtaining viable fuel may require additional costs for specialized equipment and processing of the extracted natural gas (e.g., removing liquids and other impurities and adding an odorant).

Does It Meet My Needs?

Because no two farms are exactly alike, each farm will have different needs for natural gas conversion, and the available natural gas source may or may not meet those needs. Similarly, the needs of the natural gas service provider to move forward with the conversion process will be different for each farm. Identifying, documenting, and assessing such needs is the next logical step in making decisions about natural gas conversion. Each farmer will have to ask questions of service providers, identify the farm's potential natural gas consumption, determine the appropriate timing of a conversion project, and consider service contract requirements and safeguards to decide whether the potential natural gas service will meet the farm's needs.

General Questions for Service Providers

To collect the most pertinent information about a potential natural gas conversion project, farmers need to ask some important general questions of potential natural gas service providers:

- **Local natural gas infrastructure details:** distance from the farm to the nearest natural gas pipeline; size, pressure, and load capacity of the pipeline; and whether service providers are accepting new customers
- **Financial details:** fuel cost for natural gas (with which to compare the fuel cost of propane), overall cost of completing the new service line project (and connecting the new service line to the point of end use on the farm), and natural gas meter costs or other fees for service
- **Natural gas installation details:** duration of the new service project, options for the farm to complete the manual labor, and contact information for licensed natural gas contractors
- **Natural gas service details:** service contract options, service guarantees, options for increasing local service pressure during peak demand, compensation for loss of service or project construction damages to farm property, and opportunity to extend service to other local customers

Appendix A provides a checklist of these questions to use when talking to service providers. Appendix B provides a worksheet to document the information gathered from service providers.

Who to Contact

Many Ohio farmers recognize the common challenge in getting in touch with natural gas service providers and piquing their interest in establishing new service to a farm. Knowing the right person to talk to and being prepared with the questions in Appendix A increase the odds of getting the attention of service providers.

- **Local natural gas company:** The place to start a conversation about establishing new service (or extending existing service) is with the local natural gas service provider. This could be a natural gas utility company, co-op, or other service provider. For example, some natural gas "suppliers" offer service plans with rates different from the local utility's, although these suppliers still rely on the local utility infrastructure. There may be multiple companies in the local area. If there is a transmission pipeline near the farm, the local service provider may know who owns and operates that pipeline and could provide contact information.
- **Job titles:** When calling local service providers, asking to speak with a sales representative, a field manager, or the new business department will get the conversation started quickly, minimize the time searching for the right contact, and avoid the "run-around" from the company.

- **Incentive for the service provider:** Where feasible, it can be beneficial to let service providers know that a new natural gas service to one farm can lead to other new customers for the company. Gathering interest from other local farms or nearby communities may present an attractive incentive for service providers to consider service expansion in the area.

The image on the right demonstrates the wide variety of natural gas distribution service providers across Ohio. The four colors represent different types of service providers, including large companies, small companies, co-ops, and municipal utilities. A full-size version of this map, showing the names and general operating areas of these companies per county, is available from the Public Utilities Commission of Ohio (see Appendix C).

Natural Gas Use

The expected uses for natural gas on the farm are important for determining whether the available natural gas options are adequate for the farm’s needs. Typically, potential natural gas use is based on the existing propane use on the farm. For example, a farmer who uses propane to dry grain or heat barns would calculate the amount of natural gas needed for the same functions. More information on this calculation is in the “How Much Does it Cost?” section below and in Appendix B.

Understanding the general energy demand of the farm and how much natural gas will be needed during peak demand (when the grain dryers are used) will help determine the size and pressure required for the potential new natural gas main line and subsequent service line(s) to the end use location(s). This is an important discussion to have with the natural gas service providers, who will likely offer options and limitations for what can be provided. The potential for future expansion of natural gas use—on the farm or in the local area to other customers—should be considered in discussions about main and service line size and pressure and could be leveraged as incentive for the service provider.

Timing of a Potential Natural Gas Project

When examining options for completing a natural gas conversion project, careful consideration should be given to timing—both when the project should start and how long it would take. Farmers should ask the service provider (or other contractor who would be completing the work) for an estimated timeline and strive to maintain that schedule. Depending on the conditions and complexity of the project, the work could take days, weeks, months, or over one year. Farmers will need to weigh:

- When they can absorb the disruption of grain drying and building heating while the conversion work is completed (versus when drying and heating are critically needed)
- Whether the trenching work will affect land use where new natural gas lines will be installed
- The availability of time and money to dedicate to the project in the annual cycles of planting, growing, and harvesting

Service Contract Requirements and Safeguards

Understanding the details, options, and limitations of potential service contracts with natural gas service providers will help farmers determine whether that service will meet their needs.

Natural Gas Distribution Service Providers



Source: Public Utilities Commission of Ohio

Key components of service contracts to discuss with natural gas service providers include options and rates for different types of service, service guarantees, and compensation for loss of service or project construction damages to farm property. Holding these discussions with service providers up front can prevent unexpected problems or cost increases.

- **Service contract options:** Service providers may offer options for different types of service contracts, such as firm and continual service vs. interruptible service (if service is needed only for certain times of the year). Different contract types may have different rates. Continual service may require a minimum amount of monthly use and may cost more per unit of natural gas than interruptible service. Interruptible service may require a much higher volume of minimum use but may cost less per unit of natural gas.
- **Service guarantees:** Farmers should discuss service guarantees with natural gas service providers to safeguard against changes in the local natural gas operating environment (e.g., if other customers are added in the local area, guarantees to meet the farm’s demand should be included).
- **Compensation:** Contractual provisions should be discussed for compensation if natural gas service is interrupted or cancelled for reasons outside of the farmer’s control (e.g., if local natural gas expansion by the service provider causes system pressures to drop below a usable threshold), or for damage to farm property (e.g., drainage tile) during installation of new main or service lines.

What is Required to Move Forward?

Making strategic decisions about farm natural gas conversion requires collecting and organizing many essential pieces of information. This section summarizes those pieces of information and Appendix B provides a worksheet to help document and manage the information.

Information Needs Summary

In addition to the information described above (in “What is Available?” and “Does It Meet My Needs?”), farmers will want to look at cost information for multiple stages of the project and the payback period (more information on costs and payback period is included in the “How Much Does It Cost?” section below). This information can be documented in the Farm Data Worksheet located in Appendix B.

- **Natural gas source:** source pipeline(s) nearby; source pipeline(s) type, size, and pressure; distances from the source to the new connection point and from the new connection point to end use; source connection type required; and equipment required for source connection
- **Natural gas companies:** what company and company type owns the natural gas source pipeline(s), what service provider companies are available to provide service from the source, what installation companies are available to perform the work (and whether the farmer can do any of the work), and who to contact at these companies
- **Farm natural gas use:** annual farm natural gas load, seasonal peak load, natural gas main and service line size and pressure required, and potential for additional loads or customers (e.g., farm building/residential heating, other farms nearby, other business/residential areas nearby)
- **Cost:** propane and natural gas prices; figures and formulas for comparing propane and natural gas prices; costs (including parts, labor, and permits) to connect to the natural gas source, connect the source to the new farm meter(s), and connect the meter(s) to the end use point(s); and costs associated with converting existing burner equipment
- **Timing:** how long the overall conversion project will take, the sequence and duration of different steps along the conversion process, the impact of timing on normal farm operations, whom to contact and when for permitting issues, and when to strategically schedule different steps of the process
- **Payback period:** calculating total costs of the various aspects of the conversion, calculating fuel cost savings from using natural gas instead of propane, calculating payback period based on annual fuel cost savings, and opportunities for other cost savings (e.g., government programs, equipment rebates, or trade-ins)

“Collecting all the important information and making calculations up front allowed me to have focused conversations with natural gas companies and make the decision to move forward with a natural gas conversion project. OSC’s technical assistance helped me navigate conversations with multiple companies over many months and stay organized. The amount of natural gas my drying operation would use plus the option to expand to homes and other buildings nearby made this project advantageous for everyone involved.”

– JM, participating Ohio soybean farmer

How Much Does It Cost?

Two major phases of natural gas conversion influence the overall costs: establishing the new natural gas service and converting grain drying and/or heating operations to natural gas. Once these figures are understood, calculations for potential payback period for the project can be completed.

New Natural Gas Service

Establishing the new natural gas service is the first major phase in the project work. The general process includes installing a connection to the natural gas source (transmission pipeline or local distribution system), installing a new main line from which service connection(s) to the farm will be established, installing new service line(s) to the farm, and installing new natural gas meter(s). If the farm already has natural gas service, then the farmer need only contact the existing local utility company (or co-op) to discuss extending the service to another location(s) on the farm.

- **Transmission pipeline connection:** The transmission pipeline company or local utility company installs a high-pressure farm tap on the transmission line, using a tap appropriate to the farm’s estimated use case (how much natural gas the farm expects to consume).
- **Local distribution system connection:** The local utility company or co-op installs a new connection for a new main line to the local distribution system.
- **New main line:** The local utility company/co-op, a licensed natural gas installer or other private contractor, or the farmer digs the trench for, and places, the new main line near the farm that will connect to the natural gas source (farm tap or new local distribution system connection).
- **New service line(s):** The local utility company/co-op, a licensed natural gas installer or other private contractor, or the farmer digs the trench for, and places, the new service line(s) that will connect the farm to the new main line.
- **New meter(s):** The local utility company/co-op, a licensed natural gas installer, or other private contractor installs the new natural gas meter(s) that will measure natural gas use on the farm, and makes the final connections of the meter(s), service line, main line, and natural gas source (farm tap or new local distribution system connection).

The costs for establishing new natural gas service can vary greatly, depending on the type of natural gas source, the distance from the farm to the source, and the providers’ pricing. The major cost factors include trenching, parts, labor, permits, and meters. Service providers often will include all of these factors in an estimate for a new service project. A transmission line farm tap may cost \$100,000. The cost to install new service may range from \$1.00 to more than \$10.00 per foot. Because of the many variables in cost, it is important to request an itemized list of project costs from the service provider and document the information gathered (such as in Appendix B).

Converting Grain Drying and Heating

The second major phase in the natural gas conversion process is to convert existing propane operations (grain drying or building heating) to natural gas. Grain dryers are typically fueled by propane. Propane’s chemical, physical, and energy properties are different from those of natural gas, so changing grain drying fuel from propane to natural gas entails replacing the dryer burner.

Existing propane dryers can be retrofitted with natural gas burners, which is less costly than replacing dryers. Similarly, propane-fueled heating burners can be updated for natural gas use. The process generally includes installing new or updated grain dryers and/or burners and connecting natural gas lines from the new meter(s) to where the natural gas will be used.

- **New equipment installation:** A licensed natural gas installer, other private contractor, or the farmer removes the propane burner from the grain dryer or heater and installs the new natural gas burner (or a burner that is capable of using both fuels).
- **New meter connection:** A licensed natural gas installer, other private contractor, or the farmer digs the trench for, and places, the new natural gas lines that will connect the meter to the new grain dryer or burner.
- **New equipment connection:** A licensed natural gas installer, other private contractor, or the farmer makes the final connections of the new dryer or burner to the natural gas line and the natural gas line to the meter.

Similar to establishing the new natural gas service, the major cost factors for this phase of the conversion include trenching, parts, labor, and permits. A service provider may also offer the cost for this project phase in dollars per foot of distance. Parts and labor for converting existing equipment may range from one thousand to several thousand dollars. The worksheet in Appendix B allows for documenting estimated costs for this phase, as well as the new service phase.

Payback Period

Determining the financials in a natural gas conversion project involves some calculations. The general cost factors include the estimated cost of natural gas versus propane and the total estimated cost for project execution. Calculations to determine these figures are summarized below. For the purposes of this document, payback period calculations are based on the following hypothetical assumptions:

General Cost Factors	
Annual propane use for grain drying	20,000 gallons (gal)
Estimated propane price	\$1.00 per gal
Estimated natural gas price	\$0.50 per 100 cubic feet (ccf)
Distance from farm to natural gas source	0.5 miles (2,640 feet)
Distance between new natural gas meter and new grain dryer burner	50 feet
Estimated price for completing new service phase of project	\$5.00 per foot
Estimated price for completing equipment conversion phase of project	\$2,000 plus \$2.00 per foot

Fuel Cost Comparison

Comparing the prices of the two fuels involved in the conversion is the first step to calculating the financials. Propane and natural gas exhibit different energy content as well as different prices. A logical comparison of the two fuels requires calculation of equivalent units.

- Fuel energy content is measured in British thermal units (BTU).
- Equivalent price units for both fuels are dollars per million BTU (\$/MBTU).
- Propane has 91,500 BTU/gal, while natural gas has 104,000 BTU/ccf.
- If propane costs \$1.00/gal, then its equivalent price is \$10.93/MBTU.
 - $1,000,000 \text{ BTU} / (91,500 \text{ BTU/gal}) = 10.93 \text{ gal per MBTU}$
 - $10.93 \text{ gal per MBTU} \times \$1.00/\text{gal} = \$10.93/\text{MBTU}$

- If natural gas costs \$0.50/ccf, then its equivalent price is \$4.81/MBTU.
 - $1,000,000 \text{ BTU} / (104,000 \text{ BTU/ccf}) = 9.62 \text{ ccf per MBTU}$
 - $9.62 \text{ ccf per MBTU} \times \$0.50/\text{ccf} = \$4.81/\text{MBTU}$

Estimated Annual Fuel Cost

The next step is comparing the annual cost of propane and the theoretical annual cost of the energy-equivalent amount of natural gas for grain drying.

- If a farm uses 20,000 gal of propane annually at \$1.00/gal, the annual cost is \$20,000.
- The energy contained in 20,000 gal of propane is 1,830 MBTU.
 - $(20,000 \text{ gal} \times 91,500 \text{ BTU/gal}) / 1,000,000 \text{ BTU} = 1,830 \text{ MBTU}$
- The annual energy-equivalent cost of natural gas for that amount of energy is \$8,798.
 - $1,830 \text{ MBTU} \times \$4.81/\text{MBTU of natural gas} = \$8,798$
- The annual energy cost savings is \$11,202.
 - $\$20,000 \text{ (annual propane cost)} - \$8,798 \text{ (estimated natural gas cost)} = \$11,202$

Estimated Payback Period

The estimated total cost of the natural gas conversion project divided by the estimated annual fuel cost savings determines the estimated payback period.

- For the hypothetical farm, the total estimated cost of the conversion project would be \$15,300
 - $(\$5.00/\text{ft} \times 2,640 \text{ ft}) + \$2,000 + (\$2.00/\text{ft} \times 50 \text{ ft}) = \$15,300$
- The estimated payback period for the conversion project would be approximately 1.4 years
 - $\$15,300 / \$11,202/\text{year} = 1.365 \text{ years}$

Additional information on estimating and making calculations can be found in the resources listed in Appendix C.

Cost Savings Opportunities

There may be many opportunities along the steps in the natural gas conversion process to realize cost savings and a more favorable payback period. Opportunities include conducting the manual labor for the project, maximizing the uses of natural gas on the farm, generating additional customers for the service provider, leveraging funding support mechanisms, and providing services back to service providers.

- **Conducting project manual labor:** Farmers may save a considerable amount of project cost if they can perform the manual labor for the project, especially the trenching for new natural gas lines. The cost for installing new natural gas lines could be reduced to less than one dollar per foot if the farm is able to conduct the trenching and placing of natural gas lines (and if the natural gas service provider agrees to such an arrangement).
- **Increasing natural gas use:** If natural gas is used for other purposes on the farm, such as for heating livestock barns or other buildings, the payback period may be shorter. Increased use of natural gas as a replacement for propane equates to more fuel cost savings. If the farm has extra grain-drying capacity, it may be possible to offer drying services to other farms.
- **Collaborating with other customers:** Farmers can join together with other potential new customers in a local area (such as residential or commercial districts) to negotiate bulk pricing for natural gas service and project costs. More customers in the same area adds incentive for service providers to expand their service and offer lower rates.
- **Funding support opportunities:** Government and utility programs (e.g., government grants, loan programs, and rebates for equipment) may be available to farmers to reduce the cost of the natural gas conversion.

Farmers can contact the Ohio Rural Development Energy Coordinator to obtain grant and loan financing information regarding the Rural Energy for America Program – Renewable Energy & Energy Efficiency. Also, the U.S. Department of Agriculture’s Farm Service Agency maintains a list of agriculture loan programs. Links to federal government programs are listed in Appendix C. Further, farmers may contact the local utility for information on energy efficiency incentives (e.g., grants or rebates) for natural gas conversion.

- **On-site propane storage:** For those farmers who intend to store propane as a back-up fuel for grain drying and heating, offering on-site storage service to propane service providers may be an opportunity to save on fuel costs. If the farm maintains large propane tanks, propane service providers may be interested in paying the farm to store propane on the farm for their operations.

Making the Decision

After collecting all the pertinent information, discussing options with service providers and collaborators, and making the necessary calculations, farmers can make educated decisions about natural gas conversion.

Economics

The economics of natural gas conversion are typically the ultimate driver of a farmer’s decision about proceeding with a conversion project. If the estimated overall project cost and the estimated annual savings from natural gas versus propane use present a favorable payback period, conversion may be advantageous for the farm.

Non-Economic Factors

Non-economic factors such as convenience, flexibility, and long-term stability may also influence the decision to convert grain drying and/or building heating from propane to natural gas.

- **Convenience of fuel source:** Natural gas may be considered a much more convenient fuel source for farm operations than propane. Natural gas is available constantly after service has been established, whereas propane must be delivered in bulk to storage tanks. Propane delivery must be scheduled and may not be available during holidays or weekends.
- **Flexibility:** Grain drying and building heating equipment can be set up to accept either natural gas or propane as fuel, with minimal down time required to switch between fuels. Maintaining propane storage and the proper equipment to switch between fuels allows farms to have a back-up fuel source in case natural gas service is interrupted, or if the price comparison between the two fuels no longer favors natural gas.
- **Long-term energy stability:** The U.S. Energy Information Administration estimates that natural gas prices will remain relatively lower and more stable than equivalent propane prices over the next 20 years. Also, natural gas extraction and infrastructure are expanding in Ohio (and across the United States). These factors lead to long-term energy stability for farms that use natural gas.

When Moving Forward is not Feasible

Despite the potential benefits of converting farm operations to natural gas use, the economic and non-economic factors may render natural gas conversion impractical. Possible obstacles include the natural gas infrastructure available or the overall cost of the conversion process.

Though natural gas conversion for the farm may not be feasible, the research, information, and knowledge gained from examining the options and requirements remain valuable. Farmers who choose to not proceed with natural gas conversion can reevaluate the options periodically, or when local conditions change, to determine whether conversion becomes feasible. Local distribution systems may expand to an area closer to the farm or increase their capacity. New transmission pipelines may be installed in the area and open opportunities for farm taps. Similarly, new natural gas extraction wells may be installed locally. To be prepared for such changes in the local natural gas operating environment, farmers should keep the documentation of their natural gas conversion research and calculations for future use.

“Though I decided to not go through with a natural gas project, knowing more about the topic and considerations is very helpful. With OSC’s technical assistance, I did not have to invest a lot of time trying to understand all the important details and was able to make a clear decision. If situations limiting my ability to go through with it change, I will be ready to look into it again.”

– TH, participating Ohio soybean farmer

Potential Pitfalls and Challenges

Farmers examining and potentially going through the natural gas conversion process may find themselves frustrated by a complicated process involving many variables, pitfalls, and challenges. The following are difficulties of which farmers should be aware:

- **Service provider engagement:** an overall lack of engagement and interest from service providers, difficulty in acquiring and keeping their attention, potential turnover of service provider points of contact, and difficulty identifying and hiring licensed contractors to conduct installation work
- **Cost issues:** a prohibitive total cost of conversion, disadvantageous fuel price differentials that do not justify the entire cost, transmission pipeline companies or service providers that take advantage of farmers (e.g., overcharging or not passing along opportunities for savings), and a long payback period
- **Permitting and responsibility issues:** fulfilling permitting requirements for different portions of the project; understanding state and local laws, rights of way, and easements; understanding who owns and is responsible for what portions of pipelines; and obtaining resolution for damage to agricultural drainage lines from pipeline installation

Helpful Resources

Documents, websites, and programs are available to help farmers understand the natural gas conversion process and make educated, strategic decisions about potential natural gas projects. These resources include OSC education and awareness products and calculation tools, Ohio State University Extension Service information and tools, federal government programs to help with project funding, and Public Utilities Commission of Ohio natural gas service provider information. Links and contact information for these resources are included in Appendix C.

Helpful Resources

The collage features several key resources:

- Grain Dryer Conversion to Natural Gas Case Study:** A document detailing the process of switching to natural gas, highlighting energy savings and the importance of dryer temperature control.
- Decision-Makers in the Natural Gas Value Chain:** An infographic showing the flow of information and decision-making from producers to end-users, including roles like State Government, Utility, and Distributor.
- Gas Conversion Project Payback Estimator:** A user-friendly tool with a red arrow pointing to 'Payback Period' and 'Payback Period' fields, designed to help farmers calculate the financial viability of a conversion project.
- Spreadsheet:** A detailed data table with columns for various project metrics, likely used for cost-benefit analysis and project planning.

Appendix A. Checklist of Questions for Natural Gas Service Provider

The following are questions to ask natural gas service providers regarding a potential natural gas conversion project. The Farm Data Worksheet in Appendix B can be used to document information learned from natural gas service providers.

Natural Gas Infrastructure Details

- What is the distance from my farm to the nearest natural gas line?
- What are the diameter and pressure of the nearest natural gas line?
- What is the load capacity of the nearest natural gas line?
- Can the nearest natural gas line supply what my farm needs (especially during drying season)?

Financial Details

- What is the price per one hundred cubic feet (ccf) of natural gas?
- What is the cost to install a new service line to my farm? Can you provide an itemized list of costs for the project?
- What natural gas meter costs and fees are included?

Natural Gas Project Details

- How long would it take to install a new service line?
- Can I perform the trench work? How would that affect the overall cost?
- Can you provide contact information for local licensed natural gas contractors who will do the work?

Natural Gas Service Details

- What service contract options are available? Is interruptible service available, or is continual service required? What are the different rates for different contract types?
- What service guarantees will be included? For example, if other customers are added in the local area, will I be guaranteed service to meet my demand?
- Are there options for increasing local service pressure during peak demand (when dryers are running)?
- Will I be compensated for interrupted/cancelled service (outside of my control)?
- Will I be compensated for damages to property from trenching?
- Is there an opportunity for extending service to other customers in my area?

Appendix B. Farm Data Worksheet

Farm Characteristics		Notes
Crop area (acres)		
Current annual propane use (gal)		
General distance from natural gas source to point(s) of use (ft)		
Property ownership between source and farm (y/n)		
Distance from potential new main to new service connection point (ft)		
Distance from new service connection point to point(s) of use or meter(s)		
New dryer/furnace or converting existing		
Existing dryer/furnace model		
Existing dryer/furnace rating (BTU per hour)		
Existing dryer type (high-temperature bin/column)		
New burners sought (#)		
Grain drying (#)		
Building heating (barn, house, storage, etc.) (#)		
New meters sought (#)		
Peak demand for all equipment (BTU per hour)		
Peak demand time period/seasonality		
Expectations		
Major anticipated challenges		

Natural Gas Source Characteristics		Notes
Type of company (transmission/co-op/municipal)		
Owner/operator (company)		
Connection type required (transmission, high-pressure, or standard)		
Source pressure (psi)		
Source diameter (in)		

Conversion Data	Estimated	Actual	Notes
Fuel Price			
Propane (\$ per gal)			
Natural gas (\$ per ccf)			
Natural Gas Use			
Annual farm natural gas load (ccf)			
Natural gas pressure required (psi)			
Natural gas service line diameter required (in)			
New burner rating required (BTU per hour)			
Permits Required			
Trenching (y/n)			
Natural gas installation at source (y/n)			
Natural gas installation on farm (y/n)			
Costs (\$)			
Connect to natural gas source (total)			
Parts			
Labor			
Permits			
Connect source to farm (total)			
Trenching (\$ per ft)			
Parts			
Labor			
Permits			
Natural gas meter(s)			
Meter fee(s)			
Convert grain drying/building heating to natural gas (total)			
Trenching (\$ per ft)			
New dryer(s)/new burner(s) for drying			
New furnace(s)/new burner(s) for building heating			
Parts			
Labor			
Permits			

Conversion Data	Estimated	Actual	Notes
Time to Complete Conversion			
Connect to natural gas source			
Connect natural gas source to farm			
Convert grain drying/building heating to natural gas			
Savings			
Annual propane cost			
Annual natural gas cost			
Annual fuel savings			
Additional savings			
Government programs			
Equipment rebates			
Equipment trade-ins			
Payback Period			
Total cost of conversion			
Payback period			

Reference Key for Calculations		Notes
Propane		
Pounds per gallon	4.23	
Gallons per pound	0.236	
BTU per gallon	91,500	
Gallons per million BTU (MBTU)	10.93	
10.93 gal per MBTU x \$[price] per gal = \$[price] per MBTU		
Natural Gas		
BTU per ccf	104,000	
ccf per MBTU	9.62	
9.62 ccf per MBTU x \$[price] per ccf = \$[price] per MBTU		

Appendix C. Additional Resources

The following are helpful resources to assist farmers in making decisions about natural gas conversion.

Previous OSC Natural Gas Products

To request copies of the following OSC products, contact Barry McGraw at bmcgraw@soyohio.org.

- Natural Gas Conversion Fact Sheet
- Natural Gas Decision Makers Fact Sheet
- Natural Gas Conversion Worksheet (spreadsheet)

Ohio State University Extension Service Resources

- Critical Infrastructure: Evaluating Natural Gas Utilization in Agriculture
<https://energizeohio.osu.edu/farm-energy-management/evaluating-natural-gas-utilization-agriculture>
- Evaluating Natural Gas Utilization in Agriculture – Payback Calculator Tool
https://energizeohio.osu.edu/sites/energizeohio/files/imce/v%203.0%20-%20OSC%20Natural%20Gas%20Conversion%20Worksheet_0.xlsm

Federal Government Resources

- National Pipeline Mapping System Public Viewer <https://pvnpm.phmsa.dot.gov/PublicViewer/>
- USDA Farm Loan Programs <https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/index>
- USDA Ohio Rural Development Energy Coordinator: Randy Monhemius, Tel: (614) 255-2424, randy.monhemius@oh.usda.gov, <http://www.rd.usda.gov/oh>
- USDA Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Loans & Grants <https://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-systems-energy-efficiency>;
<http://sustainableagriculture.net/publications/grassrootsguide/renewable-energy/renewable-energy-energy-efficiency/>

Public Utilities Commission of Ohio Resources

- Natural Gas Distribution Service Providers Map
https://www.puco.ohio.gov/emplibrary/files/Util/GIS/Gas_Maps/Natural_Gas_Distribution_Companies.pdf
- Natural Gas Provider Price Comparison
<http://energychoice.ohio.gov/ApplesToApplesCategory.aspx?Category=NaturalGas>