

# *The Poultry Engineering, Economics & Management* **NEWSLETTER**

***Critical Information for Improved Bird Performance Through Better House  
and Ventilation System Design, Operation and Management***

National Poultry Technology Center, Auburn University,  
in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations  
Issue No 53, May 2008

## **Economics of Converting to Natural Gas**

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Poultry growers across the U.S. are looking for every possible way to reduce energy costs. The first strategy in reducing fuel costs is to make sure you are purchasing poultry house heating fuel at the lowest possible prices. At present, a very high percentage of poultry houses in the US are heated by propane (liquefied petroleum gas, or LP). However, there are a number of locations in the U.S. where natural gas (NG) is available, or natural gas is available if the grower is willing to pay a fee to bring the gas lines to the farm. In most of these locations where there is an opportunity to convert a poultry house from propane to natural gas, it is economically advantageous to do so given current and projected price relationships between propane and natural gas.

Converting from propane to natural gas requires changing the burner orifices and associated plumbing and other equipment on the farm so that brooders and heaters will operate efficiently with natural gas. The conversion from propane to natural gas is not difficult but it must be well thought-out and done with the help of a qualified natural gas technician. In this newsletter we will explain the most important details involved in converting from propane to natural gas, discuss some of the common pitfalls and problems associated with a conversion, and then look at the economics and the possible payback based on comparative prices of propane and natural gas.

### **The Facts About Propane and Natural Gas**

- Natural gas is a mixture of lighter-than-air flammable gases, including methane, butane, ethane and pentane. Propane, on the other hand, is collected during the processing of oil and natural gas and is heavier than air. Both are explosive risks if allowed to concentrate; fortunately, both readily disperse when released into the environment.
- Natural gas is piped directly into a poultry house in the form of gas, while propane arrives at the farm in a tank truck and is pumped as a liquid into 500 or 1000 gallon holding tanks. The liquid propane evaporates from the wetted surface area in the top of the tank and is then piped into the poultry house in the form of gas.
- Generally, natural gas is sold by the therm, but in some areas is sold by the thousand cubic feet (MCF). A therm is the quantity of gas necessary to produce 100,000 BTU's of heat. A therm is approximately 100 cubic feet.
- Propane is sold by the gallon. One gallon of propane produces 91,660 BTU's of heat.
- Many old timers will tell you that natural gas does not burn as hot as propane. This is not true. The flame temperatures of natural gas and propane are almost identical at approximately 3,560°F. The reason the old timers will tell you that natural gas does not burn as hot as propane is that on a per cubic foot basis, natural gas contains

**When a grower makes the decision to convert a farm over from LP to NG all of the heating equipment in the houses must be converted by either modifying or replacing the orifices in the equipment. The regulators must also be replaced to make the plumbing system compatible with the new gas system. Every existing farm plumbing system must be inspected and sized by a qualified gas professional to make sure that the existing gas system can be converted or modified for use with natural gas.**



less than half the heat content of propane, and the old timers were not delivering the correct volume of natural gas to the appliance. It takes approximately 2.5 times the volume of natural gas to produce the same amount of heat as it does propane. Burning one cubic foot of natural gas produces approximately 1,012 BTU's of heat while burning one cubic foot of propane produces 2,520 BTU's of heat.

- The difference in heat content per cubic foot does not mean that natural gas is less desirable as a heating fuel. Fairly simple equipment adjustments enable natural gas to produce the same amount of heat as propane.
- The heat generated by both LP and NG is known for being much cleaner than that produced by oil or gasoline. NG and LP are both completely combusted in the appliance, producing mainly carbon dioxide and water as exhaust products. NG, like LP, is a good clean fuel that will not negatively impact the health or performance of the flock as long as the house is properly managed.

### **Facts About Natural Gas vs Propane Equipment & Operation**

- Most propane heating systems operate at eleven inches of water column pressure, while natural gas systems operate at seven inches water column. This means that different pressure regulators and pipe sizes (larger for natural gas) may be required.
- Different pressure regulators are needed for propane and natural gas; and pressure regulators must be matched to equipment being used. Some newer model brooders (within the last ten years) operate at 5 PSI pressure. Older brooders operate at 11 inches of water column for propane and 7 inches for natural gas. Most furnaces and tube heaters operate at 7 inches of water column for natural gas.
- For most appliances, changing from propane to natural gas requires only drilling out the burner orifice (the small hole that meters the amount of gas entering the appliance) to increase the flow rate of the gas so that about 2.5 times the volume will reach the brooder or appliance in comparison to propane. Drilling of orifices should only be performed by a qualified gas technician, using a precision machined set of numbered gas drills. The exact drill size is very critical for ensuring proper appliance performance.
- Most companies that manufacture poultry heating equipment have very detailed and specific guidelines for converting their appliances from one fuel type to another. In many cases, the gas valves on the equipment are universal and can be used for both propane and natural gas. However, in some cases the valves will need to have a tension spring adjustment made.
- There are some circumstances in which gas valves will need to be replaced. Changing from propane to natural gas should only be done under the guidance of an experienced natural gas technician. Questions regarding the suitability of appliances for use on natural gas rather than propane should be answered by the manufacturer. While this may seem complicated, changing fuel types is a very straightforward task if done with reasonable care.

### **Facts About the Economics of Choosing Between Natural Gas and Propane**

- In Broiler Belt states like Alabama, where the price of natural gas is regulated by a State agency or elected municipal district boards, natural gas rates are less likely to experience the major price swings we typically see with propane. This may result in decreased fuel price risk facing growers.
- Natural gas is sold by the therm, which will produce approximately 100,000 BTU's of heat, or in some areas by the MCF (one thousand cubic feet). An MCF is approximately equal to ten therms. Propane is sold by the gallon, which will produce 91,660 BTU's of heat. The difference in heat content means that to compare the true costs of heating (cost/BTU basis) of natural gas vs propane:

Cost of one gallon of propane = Cost of one therm of natural gas divided by 1.09 (or of one MCF ÷ 10.9)

Cost of one therm of natural gas = Cost of one gallon of propane multiplied by 1.09

Cost of one MCF of natural gas = Cost of one gallon of propane multiplied by 10.9

Examples: Natural gas at \$1.60/therm or \$16.00/MCF would have the same value as propane at \$1.47/gallon ( $1.60 \div 1.09 = 1.47$ ;  $16 \div 10.9 = 1.47$ ). Propane at \$2/gallon would be equivalent to natural gas at \$2.18/therm ( $2 \times 1.09 = 2.18$ ) or \$21.80/MCF ( $2 \times 10.9 = 21.80$ ).

Tables 1 and 2 on page 3 illustrate the true heating cost comparisons of natural gas vs propane at various price levels, starting with either the propane cost or the natural gas cost.

- Costs of making the required equipment modifications or replacements must be figured into a decision to convert to natural gas. Whether the grower or the LP company owns the propane tanks and whether they are to be removed, will also be factors to consider. In addition, growers should be aware that natural gas bills may include additional service charges, which can change from location to location but may add 5% or more to the bill.

## Example Price Points for LP to NG Conversion Decision

TABLE 1			TABLE 2		
Price of NG per MCF	Price of NG per therm	Stay with LP if you are paying less than \$/gal	Price Paid for LP	Convert to NG if less than \$/therm	Convert to NG if less than \$/1,000 cuft
\$10.00	\$1.00	\$0.92	\$2.40	\$2.62	\$26.20
\$11.00	\$1.10	\$1.00	\$2.30	\$2.50	\$25.00
\$12.00	\$1.20	\$1.10	\$2.20	\$2.40	\$24.00
\$13.00	\$1.30	\$1.19	\$2.10	\$2.29	\$22.90
\$14.00	\$1.40	\$1.28	\$2.00	\$2.18	\$21.80
\$15.00	\$1.50	\$1.38	\$1.90	\$2.07	\$20.70
\$16.00	\$1.60	\$1.47	\$1.80	\$1.96	\$19.60
\$17.00	\$1.70	\$1.56	\$1.70	\$1.85	\$18.50
\$18.00	\$1.80	\$1.65	\$1.60	\$1.74	\$17.40

Note: Price points in tables are based on the cost/BTU equivalence formulas for LP and NG explained on page 2, and do not take into consideration possible costs of conversion, which are typically minor factors in the long run but which should also be included in the decision process.



Conversion from propane to natural gas is typically advantageous in areas where natural gas lines are located close enough to the farm. The conversion process involves changes or modification of equipment, such as trading propane tanks for natural gas meters, shown at left.

- Where natural gas pipelines are not close enough to a farm to allow no-charge connection, the grower may be able to pay a fee for extension of the pipeline to get connected. Even when such fees seem very high, the long-term cost savings of natural gas may make the natural gas connection economically justified.

### Economics Example #1 – No Fee for Natural Gas Connection

Grower Jones has four poultry houses. He burns approximately 20,000 gallons of propane/year. He is currently paying \$1.90/gallon for propane to heat his houses. Natural gas is available at his farm at a cost of \$1.30/therm. Is converting to natural gas a wise consideration? Both Table 1 and 2 indicate that converting to natural gas could yield substantial savings.

#### Example Calculations:

Cost of propane: 20,000 gallons LP X \$1.90 = \$38,000/yr for LP

20,000 gallons LP ÷ 1.09 = 18,349 therms/yr NG equivalent (or 1,834.9 MCF/yr)

18,349 therms @ \$1.30/therm of NG = \$23,853/yr cost of NG (1834.9 MCF @ \$13/MCF = \$23,853/yr)

Yearly savings by switching from LP to NG = \$38,000 - \$23,853 = \$14,147

Cost of increasing pipe sizes, adding new regulators, changing orifices, and changing valves is estimated to be

\$1,000/house X 4 houses = \$4,000

First year savings of \$14,147 - \$4,000 = \$10,147

Subsequent year savings = \$14,147/yr

In this example, a very substantial fuel cost reduction is realized in the first year by converting from LP to NG.

### Economics Example #2 – \$25,000 Fee for Natural Gas Connection

Grower Jones has four poultry houses. He burns approximately 20,000 gallons of propane/year. He is currently paying \$1.90/gallon for propane to heat his houses. Natural gas is not available at his farm. He can elect to pay a fee for having the natural gas company extend the pipeline to his farm at a cost of \$25,000. After extending the pipeline he can purchase natural gas at a cost of \$1.30/therm. Is converting to natural gas a wise consideration? Even with the additional cost of extending the pipeline, converting to natural gas could yield substantial savings.

#### Example Calculations:

Cost of extending NG pipeline + cost of converting 4 houses at \$1000/house: \$29,000 financed for 2 years @ 7% = \$33,204

Cost of propane: 20,000 gallons LP X \$1.90 = \$38,000/yr for LP

20,000 gallons ÷ 1.09 = 18,349 therms/yr NG equivalent

18,349 therms @ \$1.30/therm of NG = \$23,853/yr cost of NG

Yearly savings by switching from LP to NG = \$38,000 - \$23,853 = \$14,147

First year additional cost = \$16,602 (One half of \$33,204)

Second year additional cost = \$16,602 (One half of \$33,204)

First year deficit = \$16,602 - \$14,147 = (\$2,455)

Second year deficit = \$16,602 - \$14,147 = (\$2,455)

Third year savings = (\$4,910) + \$14,147 = \$9,237

Subsequent year savings = \$14,147/yr

In this example, the "breakeven" point occurs early in the third year, and results in substantial cost reductions in subsequent years.

#### The Bottom Line

If natural gas is available, given current and projected price relationships between propane & natural gas, converting to natural gas offers an excellent opportunity to decrease annual energy costs for heating and brooding. The conversion to natural gas is likely to pay off in the longer term even if the grower has to pay a steep fee for connection.

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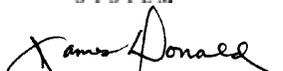
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