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ALTERNATIVE FUEL SYSTEMS – SIMPLE ECONOMICS

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Our bout with $2.00/gallon propane early last year caused serious pain in the bottom line for most growers and they are now very much aware of the need to control energy costs. This fall, even though gas prices have eased up a good bit, the number one question we are hearing from growers is "How can I reduce my fuel costs?"

Those too-high heating costs last year are also leading many growers to ask about alternative fuels and heating systems. Many have heard about alternative fuels that sound like they would be very much cheaper to operate, so much cheaper that switching to one of those systems just might take heating costs off the worry list. Alternative fuel systems have been improved in recent years, and some may well be worth looking at. However, growers should be aware that there is no national standard or independent laboratory testing or certification for poultry house heating systems, as there is for ventilation fans, for example. This means that published energy efficiency and cost comparisons of an alternative fuel with propane or natural gas should be looked at with a critical eye. Further, even accurate "laboratory-tested" data may not necessarily be what can be achieved in a poultry house. It is also well to remember that simple BTU output and operating cost numbers are not by a long shot all you need to know in order to make an economically sound decision about investing in an alternative heating system.

That kind of decision requires 1) careful thought about all the real-world factors involved; 2) research to determine the true facts (and numbers) about the given alternative fuel system; and then 3) calculation of the possible long-term gains (or losses) that would likely result. This newsletter provides the basic information you need to consider those real-world factors and the research-based facts about a whole range of possible alternative fuels and fuel systems. Plus, we are putting on our poultryhouse.com website a simple economic outcome calculator (an Excel spreadsheet) for alternative heating systems. Once you have all your facts and numbers in hand, you can use the calculator to test whether switching from propane to a given alternative heating system would pay off for you.

First, however, let's go through the first two steps in the process. We are happy to report that most of the growers we are hearing from are pretty much asking the right five questions about possible alternative fuel systems: 1) Should considering an alternative fuel system be my top priority, or are there other ways to control heating costs I should consider first? 2) Will the new system actually heat my house properly, providing a good, uniform bird environment? 3) Will it be efficient enough in operation so that I will get sufficiently lower operating costs? 4) Can I buy and install an alternate fuel system for a price that will give me a long enough service life (with lower operating costs) that I can expect to repay all costs of the new system with the quantity of propane that I have saved? 5) What assurance do I have that the alternate fuel will be available in sufficient quantities and at a reasonable price over enough years to enable me to recoup my investment?

Step 1. How much propane are you using? You need this number to make a comparison with an alternative fuel. But if your house is uninsulated, or insulated but still using too much propane, you should consider whether insulation and/or house tightening to save energy should take priority over investment in an alternative fuel heating system.

Typical Annual Propane Consumption
(gallons, for 40 X 500 Dropped Ceiling House)

Location	House Type	Big Bird 5 Flocks/Year	Small Bird 7 Flocks/Year
North AL, GA, MS	Curtain, Uninsulated	4,000-4,500	5,000-5,500
South AL, GA, MS	Curtain, Uninsulated	3,200-3,700	4,200-4,700
North AL, GA, MS	Solid, Insulated	3,500-4,000	4,000-4,500
South AL, GA, MS	Solid, Insulated	2,700-3,200	3,200-3,700

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Across the Broiler Belt, there are already many types of alternative heating systems in limited use on poultry farms. Wood, wood pellets, corn, coal, hay, peanut or soy hulls, poultry litter, used tires, and even used motor oil, just to name a few, have been burned to generate heat for poultry houses, at least on an experimental or trial basis. The systems can either heat air or heat water. They can have direct air-to-air heat exchangers or have boilers and circulate hot water, with water-to-air heat exchangers in the houses. The initial costs can range from about $10,000 to more than $60,000 per poultry house. Where any of these alternative systems have been economically successful it has been because local conditions made it possible to come up with positive answers to the five questions.

1. Should considering an alternative fuel system be my top priority, or are there other ways to control heating costs I should consider first?

Step #1 in answering this question is that you must know the quantity (gallons) of fuel per year that is used in your operation on a per house basis. Just knowing fuel bills or knowing your gas price is not enough. You need to know your usage. You also need to know how your houses stack up in comparison with other growers who have similar operations to yours. Some houses are very loose and waste a large amount of heat, and some houses are tight and very fuel efficient. The table on the front page shows typical Southeast US propane usage numbers for big bird and small bird operations. If your house is such that you are a heavy fuel user, then you need to look hard at ways to reduce that fuel usage before considering a big investment in an entirely different heating system. Even converting from curtains to solid sidewall, a move that has solidly proven benefits, often turns out to be less expensive in the long run and save as much or more in fuel costs.

The point to keep in mind is that an inefficient poultry house will consume – or waste – the same percentage of alternate fuel as it wastes with gas. If there is a hole in your bucket, you need to plug the hole, not add more water to offset the leaking.

How important is this? For example, lets say that the outside temperature is 30°F (cold) and the inside target temperature of the house is 90°F (brooding). The temperature difference between the outside of the house and the inside is then 60 degrees F. At this temperature difference, a poultry house with R-11 rated solid sidewalls can lose about 5 BTUs for every square foot of wall space every hour. The R-value of curtain material is approximately R-1, so a curtain sided house can lose about 50 BTUs per square foot every hour – TEN TIMES more heat loss than the R-11 solid wall. Air leakage can be even worse. Tiny cracks you can hardly see (but are easily detected by a smoke test and easily sealed) can easily equal a one square foot open-air hole cut into the side of a poultry house. With a 60-degree F temperature difference and only a one-mph wind blowing, that leakage will cause loss of about 5,000 BTUs per hour. That is 1,000 TIMES the heat lost from the R-11 solid wall and 100 TIMES more than the curtain. Our poultryhouse.com website offers plentiful information on insulation and house-tightening; check it out.

2. Will the new system actually heat my house properly, providing a good, uniform bird environment?

Alternative fuel systems often consist of one large furnace or heater per broiler house, and getting uniformity of heat throughout the entire poultry house can pose a problem. Traditional gas systems have multiple heating zones, but alternate fuel systems often lack this precision. This issue can be overcome through the use of strategically placed fans or ductwork for heat distribution. The key consideration is to be sure that you feel the bird environment you will be creating with the alternative fuel system will be acceptable compared to the environment achieved with the current system. A non-uniform bird environment can seriously hurt flock performance.

The “dry heat” provided by external or vented furnaces is often suggested as a significant benefit of an alternative fuel system, helping to control litter moisture. Having lower relative humidity and recirculating warm air can help improve temperature stratification and litter conditions, similarly to stir fans. However, the water contribution of an unvented propane heating system is typically less than two percent of the moisture contributed by the birds themselves. This means that proper ventilation remains as by far the most important factor in controlling litter moisture.

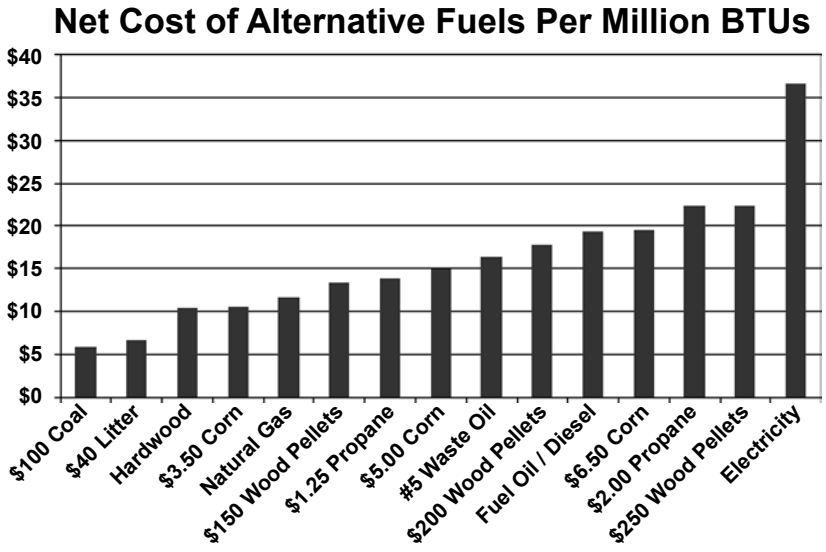
3. Will it be efficient enough in operation so that I will get sufficiently lower operating costs?

System efficiency refers to the percent of the usable heat energy provided in the house vs. the theoretical heat energy contained in the fuel. The table on the facing page lists typical as-installed fuel efficiencies of various fuels. Notice that propane and natural gas are by far the most efficient fuels. While gas heating systems are typically installed in-house and unvented, alternative fuel furnace units are typically situated outside the poultry house, so a portion of the heat produced by such a furnace is not available to utilize in the house. Some alternative fuel furnaces have been installed inside the house – there are pros and cons of both methods – but, unlike gas heaters, solid fuel furnaces require that the exhaust gases be vented out of the house, which lowers overall system efficiency.

Another consideration is that system efficiency has to be measured over a long period of time, not just under steady state (and laboratory) operating conditions. Most manufacturers of alternative fuel systems have made significant efficiency improvements in the past few years. However, even the best designed and maintained systems typically produce a net combustion efficiency of 65% to 75% (and we’ve seen many systems with efficiencies below 50%).

The table below and bar chart at right provide important data on the relative costs and as-installed energy efficiencies of various fuels.

Growers should be aware, however, that net cost per million BTUs is a measure of operating cost ONLY. Determining the economic feasibility of investing in an alternative heating system requires considering ALL the numbers, including purchase and installation of the new system, maintenance costs, interest expense, etc. A calculator tool for running all these numbers is available at poultryhouse.com.



Costs and Efficiencies of Alternative Fuels

Fuel Type	Unit	BTUs Per Unit	Cost Per Unit	Units Per Million BTUs	Percent Efficiency	Net Cost Per Million BTUs
$100 Coal	Pound	13,000	$0.050	76.923	65	$5.92
$40 Litter	Ton	5,000	$0.020	200.000	60	$6.67
Hardwood	Cord	22,000,000	$150.000	0.045	65	$10.49
$3.50 Corn	Bushel	475,000	$3.500	2.105	70	$10.53
Natural Gas	Cu.Feet	100,000	$1.150	10.000	98	$11.73
$150 Wood Pellets	Pound	8,000	$0.075	125.000	70	$13.39
$1.25 Propane	Gallon	91,660	$1.250	10.910	98	$13.92
$5.00 Corn	Bushel	475,000	$5.000	2.105	70	$15.04
#5 Waste Oil	Gallon	145,000	$2.000	6.897	84	$16.42
$200 Wood Pellets	Pound	8,000	$0.100	125.000	70	$17.86
Fuel Oil / Diesel	Gallon	145,000	$2.350	6.897	84	$19.29
$6.50 Corn	Bushel	475,000	$6.500	2.105	70	$19.55
$2.00 Propane	Gallon	91,660	$2.000	10.910	98	$22.27
$250 Wood Pellets	Pound	8,000	$0.125	125.000	70	$22.32
Electricity	kWH	3,143	$0.115	318.167	100	$36.59

How important is system efficiency? All else being equal, a furnace system with 50% efficiency will require about 15-20% more fuel than a system with 60% efficiency. Be cautious, as there is no universal method for measuring system efficiency, and most of the figures we've seen from furnace vendors seem to be optimistic. To more conservatively estimate probable fuel consumption, we recommend running the numbers with an efficiency figure at least 10% lower than the figure provided by the vendor. We also should point out that although the very low cost-per-million-BTUs of litter (in spite of its low efficiency) makes it look very attractive compared to most other fuels, as of August 2009 there are no known farm-scale litter-fired furnace systems that are commercially available.

4. Can I buy and install an alternate fuel system for a price that will give me a long enough service life (with lower operating costs) that I can expect to repay all costs of the new system with the quantity of propane that I have saved?

The percentage of propane that will be replaced and the price paid for the propane fuel that will be replaced by the alternate fuel are at the root of determining how much money is available to spend on the system and pay for the alternate fuel. Although we would hope an alternative heating system would be able to completely replace propane, the fact is that alternate fuel systems do still require some propane (or natural gas) for supplemental heat and as a backup system, so you cannot do without your existing propane or natural gas system. Most alternate fuel systems are capable of replacing 60% to 85% of the conventional propane or natural gas system.

In addition to operating costs, purchase and installation costs of the new system, along with expected (or possibly warranted) furnace service life are critical factors in the decision process. Other possible costs to be considered are the amounts of additional labor and maintenance required, on-farm fuel storage, degree of automation of fuel storage and handling, and residual ash removal and disposal.

The economic outcome calculator tool/spreadsheet available at our website provides a simple way for you to enter, in a guided step by step manner, all the relevant numbers -- house size, data on your current propane usage and cost and on the alternative fuel being considered, percent of propane to be replaced, installed cost of the new system, its efficiency, expected life span of the new system, etc. The calculator then crunches those numbers and displays a bottom-line "Total Annual Savings (Losses)" to be expected as a result of installing the new system. If the the bottom-line number is displayed in red ("Losses'), then the project is an economic "no-go".

A possible boost to the economic feasibility of some alternative fuel systems is the existence of government grants and low-interest loans under the Renewable Energy and Energy Efficiency Program operated by the Rural Development Office in each state. Contact your state's office for more information.

5. What assurance do I have that the alternate fuel will be available in sufficient quantities and at a reasonable price over enough years to enable me to recoup my investment?

This question is probably harder for most growers to answer with great confidence, but it is an important question to ask. Currently, propane has by far the most extensive and reliable national network of distributors and suppliers, although prices are likely to remain volatile. Local or regional conditions are more likely to play a larger role in availability and pricing of most of the alternative fuels, so growers must rely on local knowledge and confidence in local suppliers, as well as assessing longer-term prospects for their fuel of choice. Ask a furnace vendor if he can provide you with a long-term price guarantee.

The Bottom Line

Alternative fuel systems have greatly matured in the past several years and future improvements are likely. Installation of an alternative fuel system is a business decision and should not be made without careful consideration of all investment and operational costs. Based on current conditions, the "break-even" price of propane appears to be over $2.00/gallon. In other words, it doesn't appear to make economic sense for a grower to switch from propane to an alternative heating system until the price of propane rises significantly above its current level.

The alternative heating system calculator/spreadsheet tool is available at: www.poultryhouse.com, together with the PDF version of this newsletter. Familiarity with Excel or other spreadsheet software is not required to use the calculator.

Note: An excellent resource document entitled "A Review of Biomass Furnaces for Heating Poultry Houses in the Northwest Arkansas Region" was written by Jim Wimberly in 2008 and is available from Winrock International (www.winrock.org) or at www.biomass2.com/furnaces/furnaces.html

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