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Poultry Housing Tips

Biomass Heating Systems...Do They Make Economic Sense?

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Though biomass heating systems have successfully proven their ability to heat a poultry house in the U.S. as well as other countries, there are still a number of details that have to be worked out before they are viewed by most as a viable alternative to traditional propane heating systems. The most significant of these issues has nothing to do with system construction, operation, or management but rather with economics. Quite simply, are biomass heating systems capable of producing a relatively quick return on their rather high initial cost? To answer this question one must first determine how much a biomass heating system can potentially reduce the cost of heating a poultry house.

How much a biomass heating system can reduce a producer's heating cost depends primarily on the following factors: the price of the biomass fuel, the heating value of the biomass fuel, the overall efficiency of the heating system and the price of propane. The most significant of these being the price of propane. The simple truth is that if propane is in the vicinity of a dollar a gallon it is difficult at best to justify the cost of any biomass heating system. As propane approaches two dollars a gallon biomass heating systems tend to become more financially viable. As a result when considering purchasing a biomass heating system a producer must first make some type of educated guess as to what the price of propane will be in the next three, five, possibly ten years. The fact is that alternative heating systems tend to require a substantial initial investment and therefore a long term view must be used when analyzing the economic viability.

The next issue to be addressed is the type of biomass fuel to be burned and its cost. Ideally, you would purchase a system that is able to burn a variety of fuels, that are locally available, at a relatively low price. Furthermore, you would like to burn a fuel that has a relatively high heat content per pound (Btu's/lb) due to the simple fact the higher the heat content of the biofuel, the less you will need to purchase and handle. That being said even a low heat content fuel could be a viable option if it is very inexpensive (*Poultry Housing Tips.* Vol 20, No.14).

Last but not least you need to know the overall heating system efficiency of the biomass heating system you are planing to install. Basically you want to know how efficient the heating system is at delivering heat contained in the fuel to the birds

throughout the house. Even the most efficient alternative heating system utilizes only 85% of the potential heating value of any fuel. For example, wood pellets produce approximately 8,000 Btu's per pound burned,15% or more of which is lost up the stack or from the burning unit itself due to the fact it is located outside the house and exposed to the elements. Additionally, there are efficiency losses related to start-up, cool down, delivering heat to areas of a house where it is not needed, overheating, not delivering heat to an area of a house thus requiring the use of a back-up propane heating system, etc. (*Poultry Housing Tips.* Vol 21, No. 3). When all these factors are taken into account, the overall heating system efficiency of a biomass heating system typically ends up between 40% and 75%. Since determining overall heating efficiency of a specific unit can be difficult due to the number of factors involved, it may be best when analyzing the purchase of a biomass heating system to assume a rather conservative heating system efficiency of 60%.

The tables and formula below provide a relatively easy way of taking all the aforementioned variables in to account to help determine how much a biomass heating system can potentially reduce your heating costs. By simply plugging the table values in to Equation #1, you can quickly learn how the price of propane, the type and cost of a biomass fuel, and heating system efficiency all interact in determining how much a biomass heating system can reduce or possibly increase your heating costs.

Propane Price ($/gallon) \ Alternative Fuel Cost ($ per Ton)	$50	$75	$100	$125	$150	$200	$250
$1.00	0.23	0.35	0.46	0.58	0.69	0.93	1.16
$1.20	0.19	0.29	0.39	0.48	0.58	0.77	0.96
$1.40	0.17	0.25	0.33	0.41	0.50	0.66	0.83
$1.60	0.14	0.22	0.29	0.36	0.43	0.58	0.72
$1.80	0.13	0.19	0.26	0.32	0.39	0.51	0.64
$2.00	0.12	0.17	0.23	0.29	0.35	0.46	0.58
$2.20	0.11	0.16	0.21	0.26	0.32	0.42	0.53
$2.40	0.10	0.14	0.19	0.24	0.29	0.39	0.48
$2.60	0.09	0.13	0.18	0.22	0.27	0.36	0.44
$2.80	0.08	0.12	0.17	0.21	0.25	0.33	0.41
$3.00	0.08	0.12	0.15	0.19	0.23	0.31	0.39

Table 1. Propane/Biofuel heating cost comparison table.

BTU Correction Factors (BTUcf = Btu's/lb / 10,000)	
Wood pellets	0.80
Corn	0.80
Wood chips (10% moisture)	0.75
Wood chips (20% moisture)	0.60
Wood chips (30% moisture)	0.55
Wood chips (40% moisture)	0.50

Table 2. BTU correction factors for various biomass fuels.

Percent Savings = 1 - Table Value / (BTUcf X System Efficiency)

Equation 1. Percent savings of a biomass heating system over propane.

Example 1:

Propane = $2.20 per gallon
Wood pellets = $150 per ton
System efficiency = 70% (0.70)

Percent Savings = 1 - Table Value / (BTUcf X System Efficiency)
= 1 - 0.32 / (0.80 X .70)
= 1 - 0.57
= 0.43 or 43%

How much could the system reduce your heating costs if you are using 5,000 gallons of propane per year (one house)?

Yearly Savings = Propane cost X Gallons per year X Percent savings
= $2.20 X 5,000 X 0.43
= $11,000 X 0.43
= $4,730

Example 2:

Propane = $1.60 per gallon
Wood pellets = $150 per ton
System efficiency = 50% (0.50)

Percent Savings = 1 - Table Value / (BTUcf X System Efficiency)
= 1 - 0.43 / (0.80 X .50)
= 1 - 1.08
= -0.08

Under these conditions using wood pellets would actually increase heating costs by 8%

Example 3:

Propane = $2.00 per gallon
Wood chips = $50 per ton
(10% moisture)
System efficiency = 60% (0.60)

Percent Savings = 1 - Table Value / (BTUcf X System Efficiency)
= 1 - 0.12 / (0.75 X .60)
= 1 - 0.27
= 0.73 (73%)

How much could the system reduce your heating costs if you are using 5,000 gallons of propane per year?

Yearly Savings = Propane cost X Gallons per year X Percent savings
= $2.20 X 5,000 X 0.73
= $11,000 X 0.73
= $8,030

Determining whether a biomass heating system is a sound financial investment can be a rather difficult task because there tends to be a large number of unknowns that can have a substantial effect on potential heating cost savings associated with a system. As when making any financial decision it is likely best not to assume a best case scenario but rather take a more conservative approach by assuming more moderate gas prices, biomass fuel prices and heating system efficiencies. Furthermore, when analyzing return on investment of a biomass heating system don't forget to take into account installation costs, fuel storage and handling costs, as well as possible increased electricity usage. Last but not least, since the systems are relatively expensive, and may take a while to pay for themselves producers need to look carefully at things

such as; How long has the system been in use in poultry houses? What kind of warrantee does the system have? Will parts be available in the future.

Biomass heating systems have proven capable of dramatically reducing poultry house heating costs while at the same time producing a better growing environment (*Poultry Housing Tips.* Vol 21, No 2.) But, since they typically require a very high initial investment producers should carefully analyze the costs and benefits before purchasing.

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