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Poultry Housing Tips

The best way to cut heat costs is not to change your heating system

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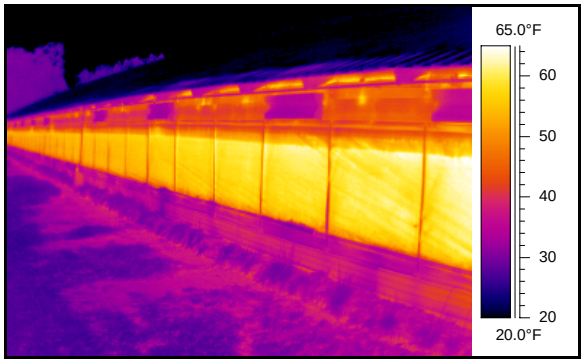

Figure 1. Thermal image of a curtain-sided house on a cold morning.

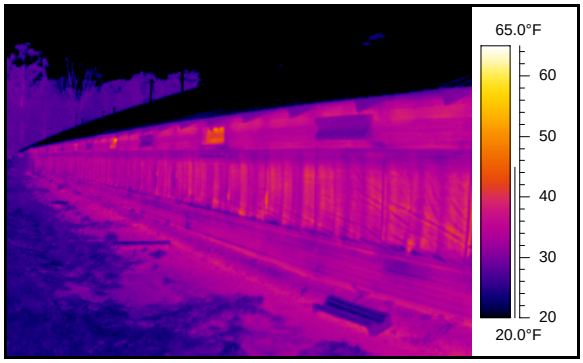

Figure 2. Thermal image of a totally enclosed house on the same farm.

With record high propane prices, many producers are questioning if there is a less expensive fuel they can use to heat their poultry houses. There are in fact a number of alternative fuels that have been successfully used for a number of years to heat poultry houses at a significantly lower cost. Some of the alternative fuels that are presently being used include coal, wood, hay, used motor oil and even corn. Producers with many of these systems have found that not only have they been able to cut their heating costs in half, but improved environmental conditions have often lead to improved bird performance. The downside is that these systems can cost from $15,000 to over $50,000 for the typical poultry house and can require more labor and a higher level of management than many traditional heating systems.

What about installing a more conventional type of heating system to reduce heating costs? For the last three years Extension Engineers, and Poultry Scientists at the University of Georgia have been conducting a field study of various conventional heating systems on a four house broiler farm in West Georgia. One house was equipped with forced air furnaces, a second had radiant brooders on the brooding end and furnaces on the nonbrooding end, and two were equipped with radiant tube heaters. Though differences in fuel usage have been documented, they have only been in the order of 10 to 20% and somewhat variable.

The fact of the matter is changing a house's heating system is not the best way for most producers to dramatically reduce their heating bills. The primary factor that determines what it costs to heat a poultry house is not the type of fuel used or even the heating system used but rather the amount of heat being used, and what determines the amount of heat being used is house insulation levels and tightness. To significantly reduce heating costs producers with curtain-sided houses need to minimize the amount of heat that is lost through side wall curtains and air leakage, which will reduce the amount of heat they have to add to the house thus lowering heating cost. As a result the best way to minimize the cost of heating a curtain-sided house is to convert it to a totally enclosed house.

To demonstrate the benefits of a totally enclosed house, one of the houses on the test farm in West Georgia was converted to a totally enclosed house by using spray polyurethane insulation. The house's 7 ½' side wall was constructed of 4" x 6" posts with 2" X 6" lumber and galvanized sheet metal above and below the 42" curtain opening (Figure 3). The curtains were rolled up and the wall was sprayed from floor to ceiling with polyurethane insulation at a thickness of ½" to 1". The polyurethane insulation was sprayed some what thinner over the lumber below the curtain opening and thicker on the curtains and the lumber above the curtain opening (Figure 4). This was done for a number of reasons. First, it has been found that a thinner, denser layer of insulation, though having a lower insulation value, is more resistant to damage from birds and beetles which was an important consideration for insulating the wood below the curtain opening. Secondly, since the wooden wall already had an R-value of approximately 4, it was felt that it didn't need as thick a foam application as the curtain which had an R-value of approximately 1.5. The fact was in many ways sealing the cracks between the boards below the curtain opening which formed over the years as boards shrank and exterior sheet metal rusted and loosened was more of a concern than the actual R-value of the lower side wall. Last but not least, cost was a consideration. By reducing the thickness of the insulation the cost of insulating/enclosing the house was reduced.

Figure 3. Side wall before polyurethane insulation was applied.

Figure 4. Side wall after polyurethane insulation was applied.

Chicks were placed on the farm in late November and the benefits of totally enclosing the one house became quickly apparent. The heating system ran significantly less, house temperatures were more uniform, and the drafts from the cracks between the boards at floor level were noticeably absent which helped to keep the young birds more evenly spread throughout the house (Figure 5, 6). By the end of the flock not only was fuel usage cut roughly in half (Figures 7, 8), but bird mortality was half that of the other houses.

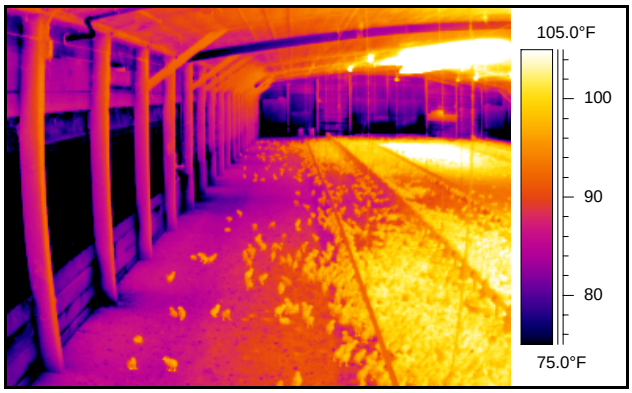

Figure 5. Thermal image of two-day-old chicks in curtain-sided house with radiant tube heaters.

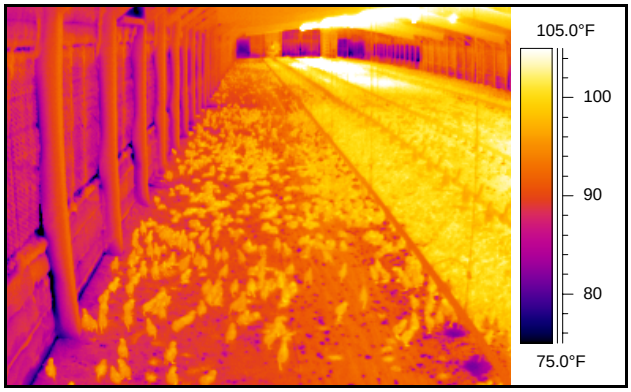

Figure 6. Thermal image of two-day-old chicks in spray foamed house with radiant tube heaters.

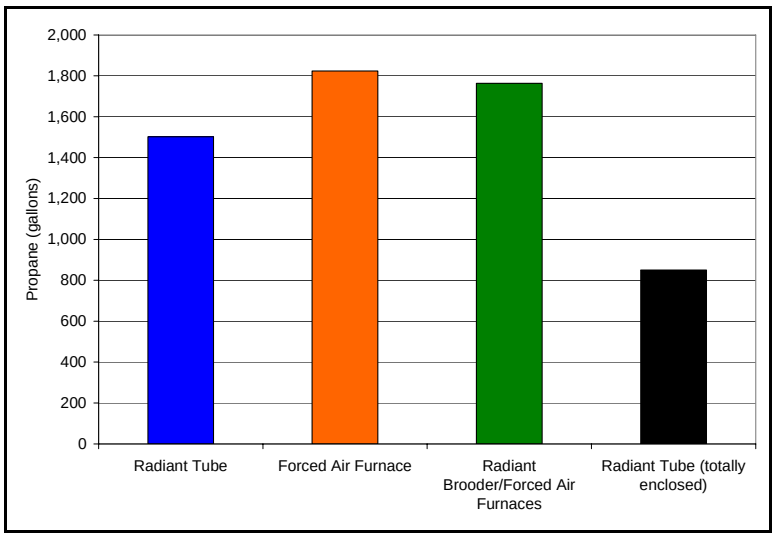

Figure 7. Total Flock Fuel Usage.

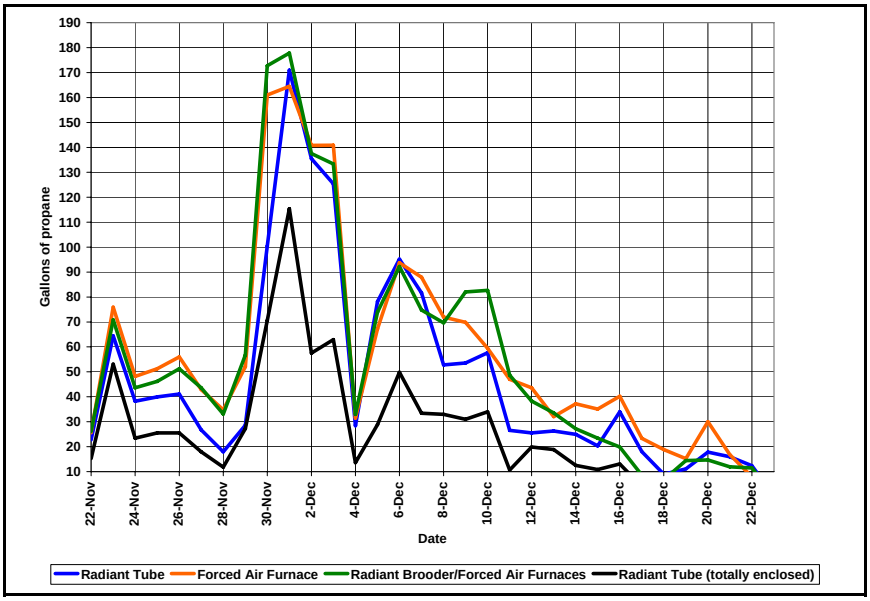

Figure 8. Daily Fuel Usage.

One particular incident that brought the reduced heating requirements into dramatic focus was when gas pressure to the houses decreased due to a combination of low gas level in the farm's 30,000 gallon propane tank and low nighttime temperatures. As the pressure decreased at night, so did the heat output of all the house's heating system. The decreased heat supply resulted in low house temperatures in all the houses with the exception of the house that was totally enclosed. For the poorly insulated and looser houses on the farm the lower gas pressure resulted in insufficient heating capacity to maintain proper house temperatures (Figure 9). Since the totally-enclosed house was losing less heat, less heat was required to maintain temperatures, and as a result the loss in heating capacity did not result in lower house temperatures.

The fact that the totally enclosed house required less heat is an important fact when considering installing an alternative fuel heating system. Since a totally enclosed house has lower heating requirement, a smaller heating system can be installed which in many cases can lower the initial cost of the heating system.

Another reason for totally enclosing a house before installing an alternative fuel heating system is had one been installed before totally enclosing the house, the issue of cracks in the side wall and leaky side wall curtains would not

have been addressed. This would have meant that even though the cost of heating the house would be reduced, chicks would have still be subjected to drafty conditions during cold weather and air quality would likely not have been improved as significantly. Furthermore, the conversion to an alternative fuel heating system would have done nothing to improve summertime conditions. Totally enclosed houses will run cooler during the summer time due to the simple fact that heat gain from hot side wall curtains is eliminated as well as the leakage of hot air through the cracks in the side wall.

Another change made to the totally enclosed house that had some effect on fuel usage and environmental conditions was the replacement of the houses 55 conventional galvanized inlets with 30 European style air inlets. The change was made in part due to the galvanized inlets being in poor shape and rather leaky. Another reason for the change was the feeling that the fewer inlets would be not only easier to manage in the long term, but they would sealed tighter, and they were better insulated than the existing galvanized inlets. Furthermore, the European style inlets tend to throw the air better to the center of the house when opened a small amount than the galvanized inlets which can lead to improved ventilation system efficiency.

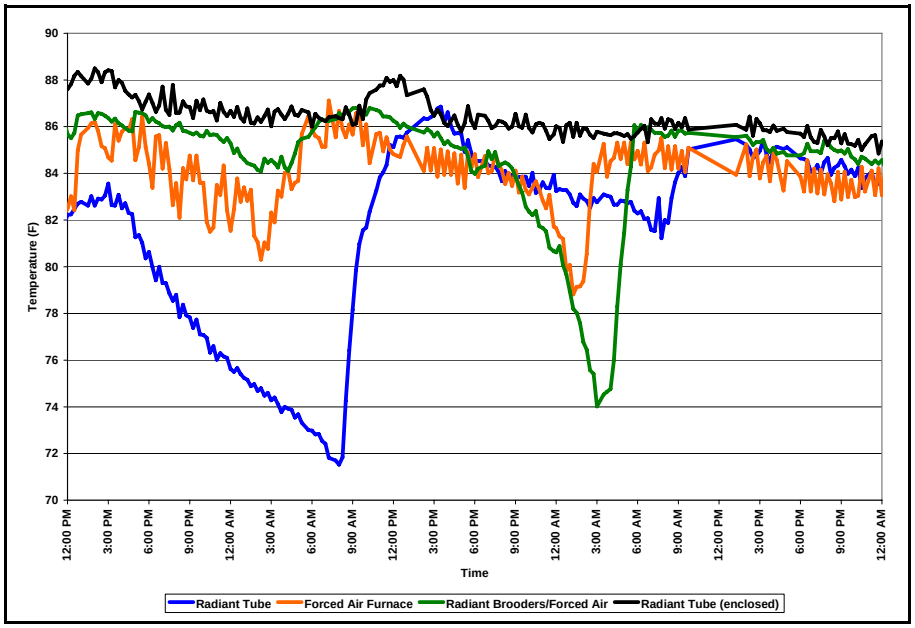

Figure 9. Average house temperature during the time of reduced gas pressure to the houses on the farm (birds seven days old).

To a large extent the increased house tightness, and to a lesser extent the new inlets, led to a much greater control over house temperature and air quality. The producer found that he could actually ventilate the house less while maintaining the same if not better air quality than in the other houses. This is because air quality is really not determined by the quantity of air brought inside but how well the air is conditioned as it enters the house. For instance, if a producer brings in 5,000 cubic feet of fresh air in a crack at floor level on a cold morning it is not only going to chill the chicks but also do a poor job of removing moisture from the litter because cold, unconditioned air has very little moisture holding ability. Conversely, if that same amount of air is brought into the house through a proper air inlet, not only will the chicks not be chilled, but a significant amount of moisture will be removed from the house. When air is directed along the ceiling by an inlet not only does it warm up but it in a sense dries out due to the fact that the moisture holding ability of air doubles for every 20^{o}F increase. The more we warm it up, the more it dries out and the more moisture it can pull from the litter. You can think of the air we bring in as a paper towel. If we don't properly heat the incoming air it is like a cheap lousy paper towel so it is going to take a lot of them to pull the moisture from the litter. But, when we heat it up the air becomes a super absorbent paper towel so fewer are needed to dry a house (less ventilation).

Another of the benefits of a totally enclosed house is that when the birds are older, since less heat is being lost through the curtains, producers can actually ventilate more without sacrificing house temperature. The heat that is lost through a curtain takes no moisture with it and therefore has no benefit. Conversely, when the same heat leaves the house

through ventilation, moisture is removed from the house which leads to drier litter. This benefit was clearly seen during the last ten days the birds were in the house. Though all the houses had identical environmental controller set up, other than minimum ventilation settings, the totally enclosed house ran on average a couple of degrees warmer. The slightly higher air temperature (Figure 10) led to more fans operating, which in turn, led to lower house humidity though all houses were more humid than they ideally should have been (Figure 11).

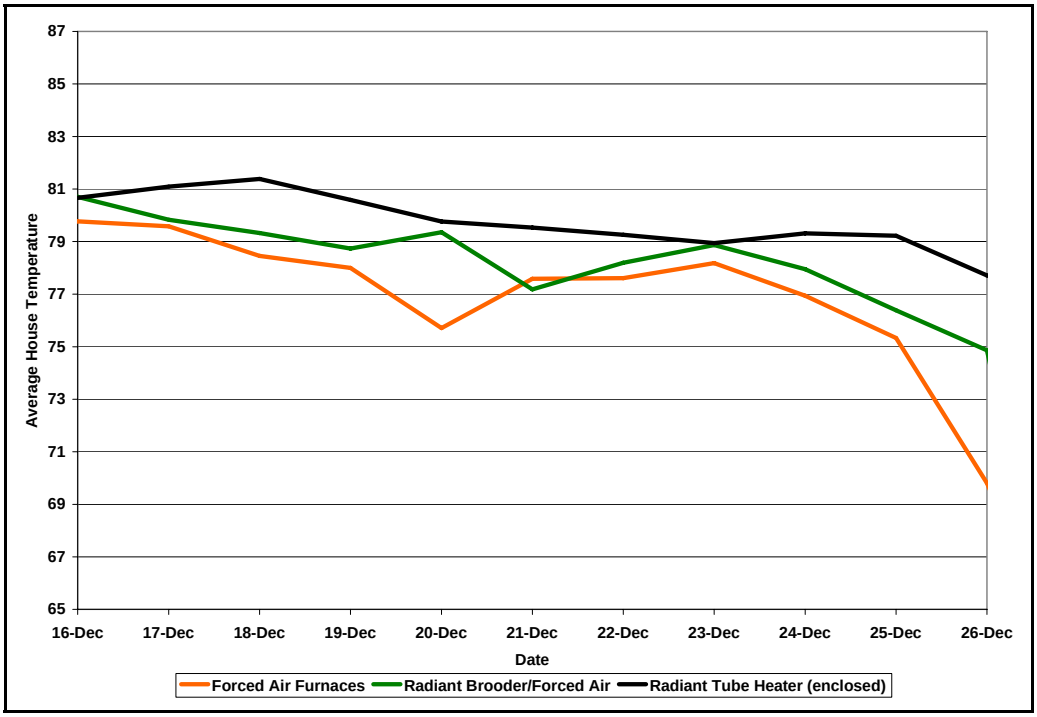

Figure 10. Average house temperatures during the last 10 days of the flock.

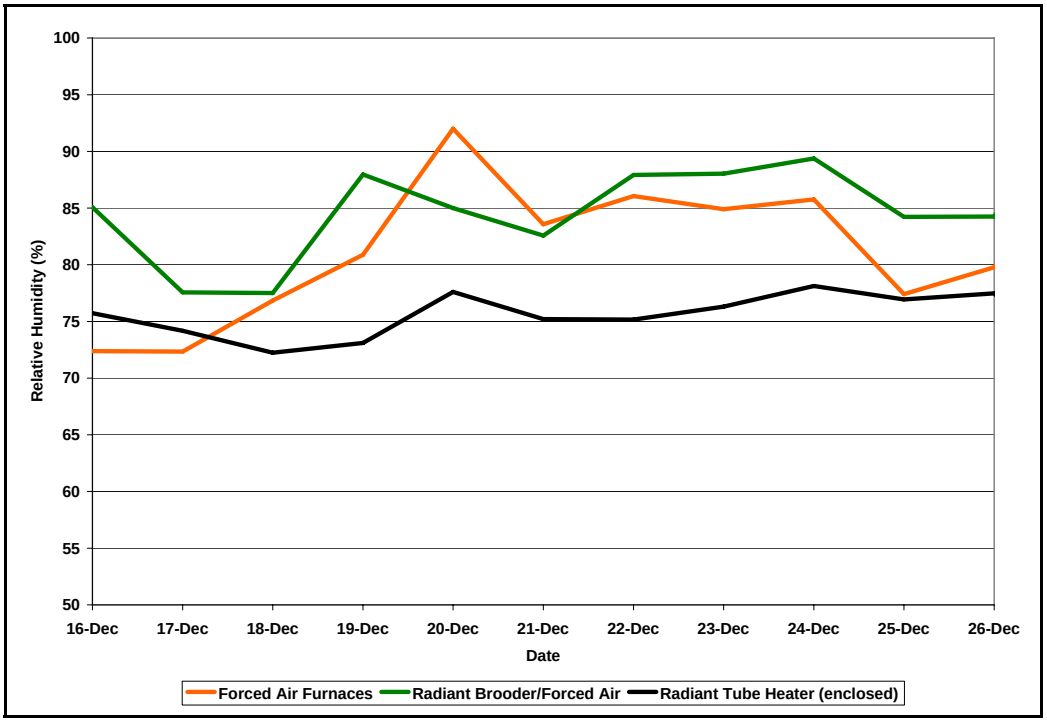

Figure 11. Average house relative humidity during the last 10 days of the flock (data for the second radiant tube house is missing due to sensor failure)

It is important to note that enclosing a house with spray polyurethane insulation is just one method of totally enclosing a curtain-sided broiler house and there are still serious questions about its long term effectiveness. Other methods of enclosing curtain-sided houses when done properly should produce similar results and will be the subject of future newsletters. The fuel savings on this particular farm were due not only to the elimination of the side wall curtain and associated leakage but due to the increased insulation value and tightness of the entire side wall. Precise fuel savings will differ from house to house depending on a variety of factors such as house tightness, side wall construction, outside/inside temperatures, etc. That being said, it is not uncommon to find a savings of 25 to 50% by eliminating side wall curtains. In addition, do not forget about bird performance. A number of poultry companies have documented a quarter of a cent or more lower cost per pound after a house is totally enclosed making the argument for totally enclosing a curtain-sided house even more convincing.

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