Energy-saving practices for poultry operations

Note: *Data in this series were obtained through the Missouri Agricultural and Energy Savings Team – A Revolutionary Opportunity (MAESTRO) program. The MAESTRO program was created to strengthen the financial viability of Missouri's livestock producers through energy efficiency. Specifically, participants in the program were livestock producers who were not required to be permitted as confined animal feeding operations (CAFO). MAESTRO was a grant-funded program that provided cost-share assistance to implement energy-efficient practices recommended in energy management plans through low-interest loans and rebates. Although these guides refer to energy savings in Missouri, many of the concepts described may apply to operations throughout the Midwest. Visit* http://extension.missouri.edu/energy *if you are interested in more energy-saving recommendations.*

The poultry industry continues to be an important component of Missouri's economy, with the 2007 census reporting $1.68 billion in sales. Poultry represents 16.8 percent of Missouri's agricultural sales and ranks third in sales behind only grain crops and cattle. Poultry operations are highly efficient environments in which temperature, humidity and lighting are closely monitored to raise high-quality birds. Because birds are raised in such closely monitored environments, these operations are also large consumers of propane and electricity. Implementing energy-efficient measures recommended in an energy audit can help poultry operations realize substantial energy and monetary savings.

An energy audit is an in-depth examination that makes several efficiency determinations:

- If and how energy is being wasted
- Which systems are operating inefficiently
- What cost-efficient measures can be implemented to improve your operation's energy efficiency

To explain further, an energy audit evaluates current operations, makes calculations of existing systems' efficiency and compares them to proposed new systems. The Agricultural Energy Management Plan (AgEMP) that follows an energy audit explains any energy-saving measures recommended for the farm. AgEMP reports might qualify for financial assistance from various funding sources, including but not limited to federal grants, loan programs or energy tax credits.

Missouri poultry producers received energy audits and AgEMP reports as part of the MAESTRO program, which was created to strengthen the financial viability of Missouri's livestock producers through energy efficiency. All data on potential energy savings for poultry farms were obtained through this program. Program participants represented farms smaller in size than their CAFO counterparts. Producers entering the program provided information on their current energy usage. The average size of poultry farms participating in the program varied based on the type of birds:

- Broiler farms averaged 83,533 birds per farm and raised six flocks per year.
- Turkey farms averaged 23,829 birds per farm and raised four flocks per year.
- Pullet farms averaged 81,000 birds per farm and raised two flocks per year.
- Layer farms averaged 48,000 birds per farm and raised one flock per year.

Table 1 shows the average savings per farm, as well as the installed cost of implementing energy-efficient retrofits recommended in AgEMP and Technical Assistance reports.

The energy savings from practices recommended in the MAESTRO program were determined by analyzing energy usage data and current equipment used in individual poultry farms in Missouri. Participants were able to apply for grant funding to offset the

Table 1. Average energy savings per farm.

Energy type	Current usage	Average savings per farm	Savings per year	Installed cost per practice
Electricity	77,645 kWh	25,349 kWh (33%)	$1,783	$13,347
Propane	20,816 gal.	2,325 gal. (11%)	$3,550	$17,529

costs of implementing new practices. Program researchers found three areas in which poultry operations saw the highest energy savings:

- LED lighting
- Converting from pancake to brooder radiant heaters
- Insulation

Growers who had contracts with poultry companies discussed all changes and upgrades with their respective contractors before proceeding with retrofits.

Lighting

Lighting choices directly affect bird performance and profits. The recent trend toward tunnel-ventilated poultry houses for broilers has increased the need for quality, uniform lighting. As reported in the MAESTRO Best Practices Guide, LEDs are 85 percent more efficient than incandescent bulbs and maintain high-quality lighting years after installation. University of Arkansas Research and Extension data indicate LEDs maintain 70 to 80 percent of their light output two years after being installed in broiler houses. The MAESTRO Best Practices Guide offers four tips to ensure farmers continue to reap the benefits:

- Choose lights specifically designed for your type of livestock.
- Choose lights that come with a warranty of three years or longer.
- Choose lights that have a color temperature between 3,500 and 6,400 Kelvins.
- Check with an integrator to ensure LEDs are allowed.

Ease of installation makes upgrading to energy-efficient lighting a relatively simple change. The change from incandescent bulbs to LEDs came up frequently in the MAESTRO program, as the majority of participants who owned poultry operations used 60-watt incandescent bulbs to light their poultry houses. Sixty-three percent of poultry producers who made energy-efficient retrofits as part of the MAESTRO program installed LED lighting in their poultry houses (Table 2).

Table 2. Average lighting practice energy savings per farm.

Energy savings	Savings per year	Installed cost
22,455 kWh	$1,903	$10,618

LEDs are being more commonly used in broiler, turkey, layer and breed production facilities as the cost per bulb continues to decline. Cost-share assistance available through the MAESTRO program also helped with the cost of installing LED bulbs. The savings in life-cycle costs outweigh the upfront costs due to LED bulbs' low energy cost and relatively long life cycle.

Radiant brooder heaters

Radiant heaters are better than conventional hot-air furnaces because they are more energy-efficient and can travel through still air to heat the birds on the floor. Radiant brooders have 15 to 30 percent lower fuel consumption than hot-air heaters and pancake brooders, and they have the distinct advantage of heating the birds and the floor rather than the air. According to the MAESTRO Best Practices Guide, lower fuel consumption makes radiant heaters an optimal choice in energy-efficient heating for poultry houses (Table 3).

Table 3. Average radiant brooder heater savings per farm.

Propane savings	Savings per year	Installed cost
28,864 gallons	$3,669	$16,873

Radiant heaters can be mounted higher in the house, so there is no need to raise or lower the heaters, and they take less time to preheat. Poultry producers can install a conventional radiant brooder or a radiant tube heater, in which hot air from a burner is forced through a metal pipe, causing it to heat up to temperatures as high as 1,000 degrees F. The outer surface of the pipe then radiates the heat to solid objects such as the floor. Heat that rises toward the ceiling is deflected downward by reflectors mounted high in the houses.

Thirty-seven percent of poultry producers who installed energy-efficient measures as part of the MAESTRO program installed one form of radiant heating in their poultry houses.

Radiant brooders have a larger radiant zone than pancake heaters because radiant brooders have a larger radiant element. Radiant brooders mounted higher off the floor create a larger radiant zone. According to University of Georgia Cooperative Extension data, this zone can be as wide as 40 feet in diameter resulting in large, loosely packed circles of birds on cold winter mornings. Equipment dealers often take care of the installation of radiant brooders, but some MAESTRO participants did so without assistance from professional installers.

Insulation

Proper insulation of a poultry building is imperative to

maintaining a consistent temperature. Poultry producers can greatly improve facilities by sealing air leaks and insulating poultry houses to adequate R-values (Table 4). There are several different recommended R-values for poultry houses, and the necessary level of insulation depends on whether the building includes a heating system. For instance, in layer houses where there is no artificial heat, R-values of 9 to 12 are recommended for walls and 16 for ceilings. In broiler houses where artificial heat is needed, an R-value of 13 is recommended for walls and 24 for ceilings.

Table 4. Average building envelope insulation savings per farm.

Propane savings	Savings per year	Installed cost
13,837 gallons	$1,775	$10,833

Proper insulation and sealing of air leaks is crucial, as producers strive for consistent temperatures and humidity levels inside poultry houses. Producers often seal small air leaks with foam insulation, but tunnel-ventilated houses need proper insulation in walls and ceilings. In tunnel-ventilated poultry houses, large openings on one end bring fresh air into the house. Air is drawn into these openings, through the house and then expelled through strategically placed outlets or fans. Tunnel-ventilated or solid-wall houses are more energy-efficient than conventional poultry houses with curtains because they allow for wall insulation and lack the air leaks that come with curtains.

In poultry houses that have not converted to tunnel ventilation, installing insulated curtains is crucial to protect against winter winds and cold temperatures. Curtains should fit snugly against walls to avoid air leaks and insulate properly in the wall around curtains. By properly insulating the curtain-ventilated poultry house, producers can realize significant savings on energy costs.

The MAESTRO program included poultry producers who owned tunnel-ventilated houses and those who owned curtain-ventilated houses. Thirty-one percent of poultry producers who installed energy-efficient measures as part of the MAESTRO program sealed air leaks and added insulation to their building envelope.

Due to the declining number of curtain-ventilated poultry houses, a lower percentage of poultry producers participating in the program upgraded to insulated curtains in their poultry houses (Table 5). Nine percent of the poultry producers who installed energy-efficient measures as part of the MAESTRO program installed insulated curtains to their poultry houses.

Table 5. Average insulated curtain savings per farm.

Propane savings	Savings per year	Installed cost
725 gallons	$1,155	$2,796

Poultry houses' foundation walls are often overlooked when it comes to insulation. Concrete walls should be covered with foam insulation or soil to avoid heat loss. Foundation walls typically consist of concrete blocks, and an 8-inch concrete block wall has an approximate R-value of 0.64. Adding some type of insulation to your foundation walls is highly recommended.

Is an energy audit necessary?

Poultry producers considering an energy audit may wonder how they can determine if an audit is necessary for their operation. If the answer to any of these four questions is yes, an energy audit may be in order:

- Have you recently added equipment to the farm?
- Have there been any technological or industrial advancements that improve efficiency?
- Has your farming operation grown or expanded to include new property?
- Is there an opportunity to apply for financial assistance (grant, loan or cost-share)?

Additional information

Visit *extension.missouri.edu/energy* for more information and access to tools developed by MU Extension that allow producers to conduct self-evaluations to assess potential energy loss or inefficiency in a farming operation.

References

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Notes

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