

Top Money-Saving Practices on Missouri Poultry Farms

The poultry industry continues to be an important component of Missouri's economy, with the 2007 census reporting \$1,676,632,000 in sales. This figure represents 16.8 percent of Missouri's agricultural sales and ranks third in sales in Missouri only behind 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 a closely monitored environment, these operations are also large consumers of propane and electricity. However, 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 of a farm 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 energy-efficiency.

To explain further, an energy audit evaluates the current operation, makes calculations of existing systems' efficiency and compares them to proposed new systems. The Agricultural Energy Management Plan (AgEMP) created afterward explains any energy-saving measures recommended for the farm. AgEMP reports may 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 AgEMPs 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 were not required to be permitted as a Confined Animal Feeding Operation (CAFO) and therefore represent farms smaller in size than their CAFO counterparts. Producers entering the program provided information on their current energy

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usage. The average size of poultry farms participating in the program varied based on the type of birds raised:

- 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 details the average savings realized per farm, as well as the installed cost of implementing energy-efficient retrofits recommended in AgEMP and Technical Assistance (TA) reports.

The energy savings realized through 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 help share the 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.

Table 1. Average energy savings per farm

Energy type	Current usage	Average savings per farm	Average savings per farm	Savings per year	Installed cost per practice
Electricity	77,645 kwh	25,349 kwh	33%	\$1,783.81	\$13,347.11
Propane	20,816 gallons	2,325 gallons	11%	\$3,550.53	\$17,529.90

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. To ensure farmers continue to reap the benefits years after installation, the MAESTRO Best Practices Guide offers these four tips:

- Choose lights specifically designed for your type of livestock.
- Choose lights that come with a three-year warranty or better.
- Choose lights that have a color temperature between 3,500 and 6,400 Kelvin.
- Check with your integrator to make sure LEDs are permitted.

Ease of installation makes upgrading to energy-efficient lighting a relatively easy change. The change from incandescent to LEDs was a frequent recommendation 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 installed energy-efficient measures as part of the MAESTRO program installed LED lighting in their poultry houses.

LEDs are used in broiler, turkey, layer and breed production facilities on a more frequent basis 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 cost due to LED bulbs' low energy cost and relatively long life cycle. Long-term energy savings and bulb lifespan offset the initial costs.

Table 2. Average lighting practice energy savings per farm

Energy savings	Savings per year	Installed cost
22,455 kWh	\$1,903.04	\$10,618.94

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 also have the distinct advantage of heating the birds and the floor rather than the air. According to the MAESTRO Best Practices Guide, that makes radiant heaters an optimal choice in energy-efficient heating for poultry houses.

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 Fahrenheit. The outer surface of the pipe then radiates the heat to solid objects like the floor. Heat reflected upward is deflected downward by reflectors.

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 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.

Table 3. Average radiant brooder heater savings per farm

Propane savings	Savings per year	Installed cost
28,864 gallons	\$3,669.23	\$16,873.40

Insulation

Proper insulation of a poultry building is imperative to maintaining a proper temperature. Poultry producers can greatly improve facilities by sealing air leaks and insulating poultry houses to adequate R-values. There are several different recommended R-values for poultry houses, and the necessary level of insulation depends on whether the poultry house 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.

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.

Table 4. Average building envelope insulation savings per farm

Propane savings	Savings per year	Installed cost
13,837 gallons	\$1,775.91	\$10,833.10

In poultry houses that have not converted to tunnel ventilation, installing insulated curtains is crucial to protect against winter winds and cold temperatures. Make sure curtains 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 ventilation 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. 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	\$1,155.33	\$2,796.27

Poultry houses' foundation walls are another often-overlooked area of insulation. Make sure concrete walls are covered with either 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 wall is highly recommended.

Determine whether an energy audit is 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 basic questions is yes, an energy audit may be in order.

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

For more 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.

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