National Poultry Technology Center, Auburn University

The *Poultry Engineering, Economics & Management*

NEWSLETTER

Critical Information for Improved Bird Performance Through Better House and Ventilation System Design, Operation and Management

Produced in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations

Issue No 59, May 2009

Energy Efficient Lighting

*By Gene Simpson, Jim Donald, Jess Campbell, Ken Macklin, and Neil Burrow**

While broiler house lighting typically only accounts for 15 to 25 percent of a broiler grower's total annual electric bill, depending on house type and location, it is still a significant cost. Recent developments in light bulb technology now make it possible to replace standard or longer-life incandescent bulbs with new energy efficient bulbs which are more cost-effective. High pressure sodium vapor lights have a very high initial cost and do not provide good light uniformity. Light Emitting Diode (LED) bulbs typically produce a cone-shaped, non-uniform light pattern, are very expensive, and also may require some detailed electrical work to be undertaken, but they may become more affordable over time. At the present time, Cold Cathode (CC) and Compact Fluorescent (CFL) bulbs seem to offer broiler growers the best opportunity to achieve energy-efficient, uniform lighting in a cost-effective manner. Widespread replacement of incandescent bulbs with CC/CFL bulb combinations is occurring across the Broiler Belt. When done correctly, a CC/CFL combination can result in reducing a broiler grower's lighting cost by as much as 85%. This newsletter will focus on CC/CFL lighting technology and how growers can easily realize these savings.

The National Poultry Technology Center (NPTC) began a project in April 2008 to demonstrate the cost reduction of CC/CFL bulb combinations in commercial broiler houses. Alabama Power Company installed high level circuit monitoring and data recording equipment on an older typical solid wall 40- X 500-foot tunnel ventilated commercial broiler house on a multi-house farm in North Alabama. During the first flock, conventional incandescent lights were used with dimmers on circuits located above the feed lines, and on non-dimming circuits down the house center. During the brood period, all brood end lights were operated at full intensity. Following brood, feed line and center lights in the off end were turned on and the flock was turned out to whole house. After birds settled in to whole house and migration fences were installed, all center line lights were turned off and front and rear feed line circuits were dimmed to very low intensity. This lighting program was specified by the integrator and was maintained for the rest of the growout.

**Neil Burrow is an energy consulting specialist with Service Concepts in Indianapolis, IN.*
All other authors are with the National Poultry Technology Center at Auburn University.

Cold cathode (CC) and compact fluorescent (CFL) light bulbs use dramatically less power than incandescent lighting. Poultry growers across the Broiler Belt are replacing their incandescent bulbs with CC/CFL bulb combinations, saving as much as 85% on lighting costs. Photo shows two clear-globed CC bulbs at left and a frosted globe CC on the right; third from left is a CFL bulb.

Before the second flock was placed, all incandescent bulbs on dimmer circuits were replaced with 8 watt CC bulbs, and all center line lights (non-dimmer circuit) were replaced with 42 watt CFL bulbs. The 8W CC bulbs emitted the equivalent light of a 45W to 55W incandescent bulb, and the 42W CFL bulbs emitted the equivalent light of a 150W incandescent bulb. During brooding, the primary goal was to provide as much light as possible using 8W CC bulbs on the dimmer circuits, and then adding enough 42W CFL bulbs in the center to maintain the 3 foot candle (fc) minimum reading required by the integrator. The identical lighting program used in the first flock was used in the second, third, fourth, and fifth flocks. No change in flock performance was noticed when comparing this house with like houses on the same farm. For this typical North Alabama broiler house, approximately 50 CC and 14 CFL replacement bulbs were used at a total cost of approximately $450. Usage readings from the monitoring equipment and actual electric bills were used to calculate all costs. Electrical cost was assumed to be 11.5 cents per kWH.

Major Findings of the Study

- CCs work very well with modern dimmers. Older dimmers may need one 75-100W incandescent bulb in the CC circuits to avoid erratic dimming.
- CFLs do not dim very well (even those claiming to be dimmable CFLs); and when used on dimmer circuits CFL bulb life appears to be shortened dramatically.
- CC and CFL bulbs both produce very uniform light, with no trace of any shadowing effect.
- CC/CFL combinations can meet most company lighting program requirements (3 to 5 foot candles for the brood period; varies by company).
- Lower power draw of CC/CFL lighting allows lighting cost saving of up to 85%, with payback of investment as short as two flocks.
- 10-20 times longer life of CC and CFL bulbs over incandescents (typically only 800-1,200 hours) more than compensate for higher cost.

Energy Efficient Light Bulb Facts:

- Cold Cathode (CC) – Bulb is an 8W (45-55 W incandescent equivalent) – 15-18% of incandescent power draw, with a typical life of 22,000-25,000 hours.
- Available light color spectrum (in degrees Kelvin) = 2,200-2,300 K; 2,700-2,850 K (preferred); & 4,000-4,100 K.
- Clear bulb CC globes are preferable to frosted bulb globes. Price: $7.00-$7.50.
- Compact Fluorescent (CFL) – use only about 18-28% of incandescent power draw and have a typical life of 12,000-18,000 hours. Bulb sizes vary by brand, but most common CFL bulbs are:

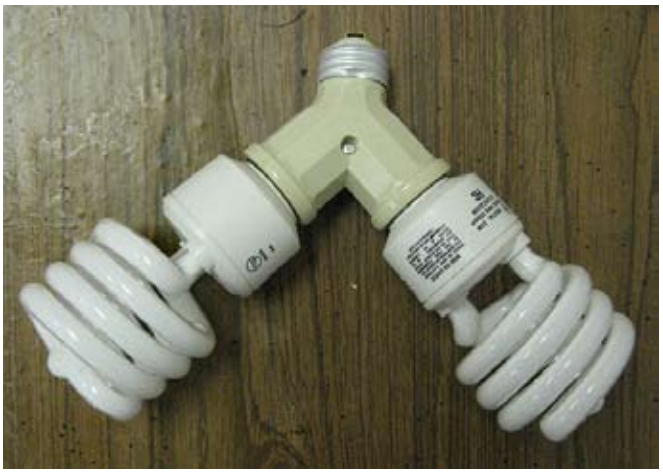
  23-28W (100W incandescent equiv) – 23-28% incandescent power, 2,700 K & 4,100 K, Price: $4.00-$4.50.

  40-42W (150W incandescent equiv) – 27-28% incandescent power, 2,850 K & 4,100 K. Price: $7.00-$8.00.

  55-65W (300W incandescent equiv) – 18-22% incandescent power, 2,700 K & 4,100 K, Price: $17.00-$20.00.

In discussions with many different broiler companies and with thousands of these bulb combinations in use in the field, the common observation is that CC and CFL bulbs in the 2,700 to 2,900 K spectrum range are most conducive to optimal broiler performance in a commercial setting. In most commercial houses, water consumption was slightly improved for flocks provided light within this color spectrum range relative to those in either the lower or higher spectrum ranges. Increased water consumption generally implies increased feed consumption. Other color spectrum ranges may be better suited to pullets and hens.

The table on page 3 provides a summary of electricity usage and cost by circuit type (fans or lights). Percentages do not add to 100% since other circuits (pumps, feeder motors, control room equipment, etc.) account for the remaining percentage of electrical usage. Also on page 3, charts showing the electrical usage breakdown are presented.



Twin Socket Adapters (Y-Splitters)

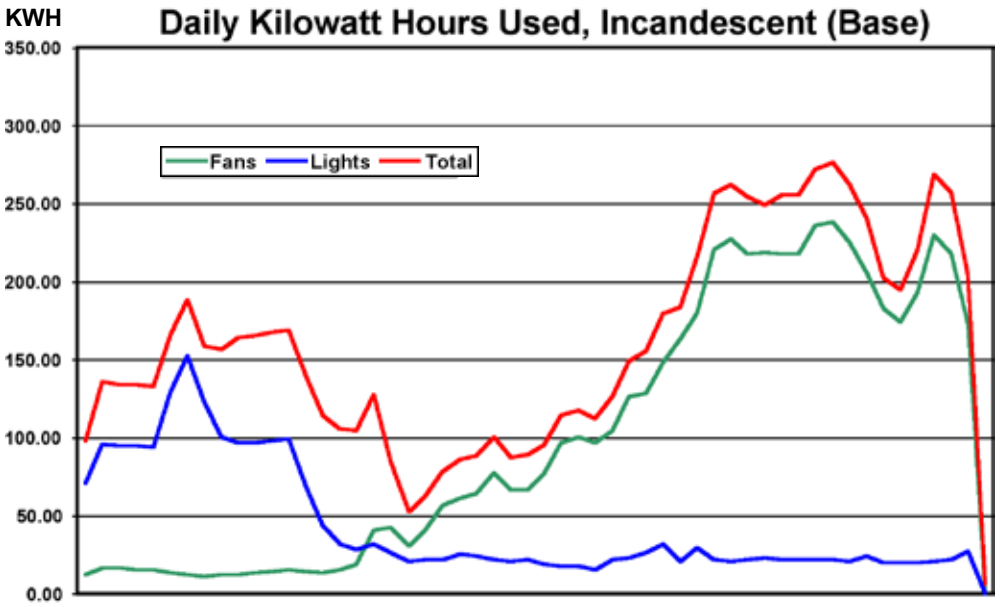
If light meter readings are just below acceptable levels, the use of a twin socket adapter or “Y- splitter” to accommodate two bulbs, as shown in photo at right, may achieve the desired target. Y-splitters can be used with CC bulbs on dimmable circuits and with CFL bulbs on standard circuits without any problems. For example, a Y-splitter

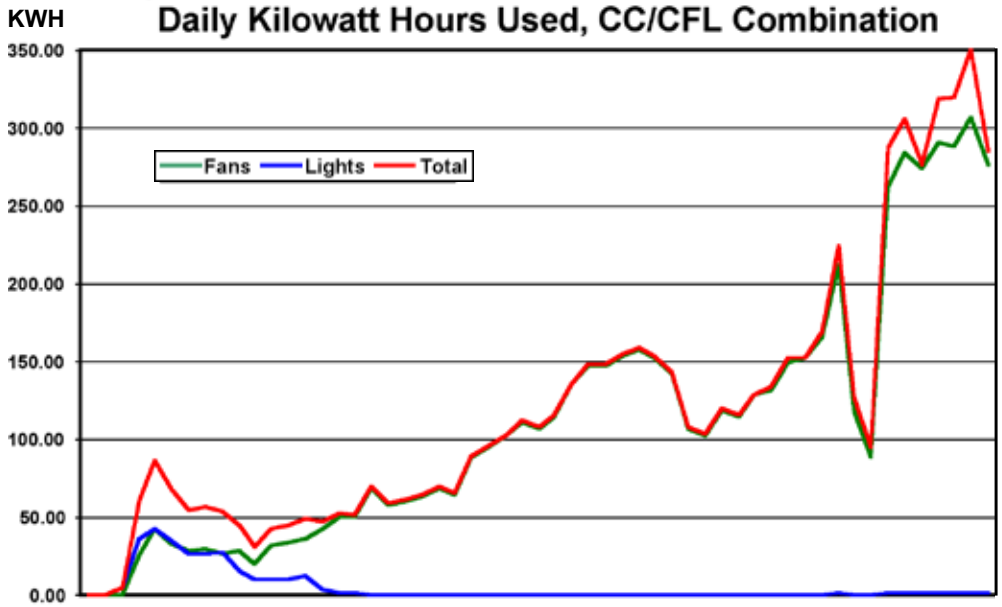
Electrical Usage And Economics Summary Table – Incandescent vs. CC/CFL Combination

For five flocks in a typical 40' x 500' solid wall, tunnel ventilated broiler house, North Alabama, 2008-2009

Flock No.	Bulb Type	Total KWH	Fan KWH	Light KWH	Total Electric Cost	Fan Electric Cost	Light Electric Cost	Light Electric Savings	Light Cost Reduction Percentage
1	Incandescent	8,688	5,409	2,329	$999	$622	$268	-Base-	-Base-
	% of total electric usage and cost →		***(62%)***	***(27%)***					
2	CC/CFL	6,572	6,091	291	$756	$700	$33	$235	87.7%
	% of total electric usage and cost →		***(93%)***	***(4%)***					
3	CC/CFL	3,688	2,144	429	$424	$247	$49	$219	81.7%
	% of total electric usage and cost →		***(58%)***	***(12%)***					
4	CC/CFL	3,172	1,371	523	$365	$158	$60	$208	77.6%
	% of total electric usage and cost →		***(43%)***	***(17%)***					
5	CC/CFL	4,006	3,512	311	$461	$404	$36	$232	86.6%
	% of total electric usage and cost →		***(88%)***	***(8%)***					

Average per flock lighting savings was $223.50 per house, compared to initial base flock.
Total cost of CC & CFL bulbs was approximately $450.00 per house.
Full payback of initial investment occurred within approximately 2 flocks.
Expect to have much longer bulb life with cold cathode & compact fluorescent bulbs.





Comparison of day by day electric usage for flocks grown with incandescent vs CC/CFL lighting shows that the dramatically lower power draw by cold cathode/compact fluorescent lighting means that in a CC/CFL-equipped house lighting power draw (blue lines) is almost negligible, and almost all house electric power consumption is accounted for by fans (green lines). See table above for the numbers.

Fan power draw in the two charts differs somewhat because of slightly different conditions during the two growouts.

with two150W equivalent CFL bulbs rather than one 300W equivalent bulb would be less expensive initially. Also, if slightly more light over the feed lines is desirable, the use of a Y-splitter and two 8W CC bulbs would be sufficient. Y-splitters will not work if bulbs are required to be in glass globe enclosures commonly called “jelly jar fixtures.”

Additional Wiring Needs

We have encountered a few older open ceiling houses which may require additional receptacles or circuitry in order to provide any level of reasonable lighting at all, regardless of bulb type. The cost of additional wiring in these houses would still be only $500 to $1,500 (plus bulb cost), so rapid payback can still be realized.

Bulb Disposal Issues

Cold cathode and compact fluorescent bulbs contain mercury, which is a toxic element. CC bulbs contain only about 10% as much mercury per bulb as CFLs. At present, there are no national laws specific to CC or CFL bulb disposal, but local or state laws may apply. In the event of bulb breakage, the affected area should be thoroughly cleaned. Spent and broken bulbs should be double bagged and taken to a recycling center which accepts items of this type.

The Bottom Line

We in the National Poultry Technology Center are committed to helping growers reduce costs wherever possible, without sacrificing bird performance. In our study, we have seen no difference in bird performance, but growers are saving $200 to $250 per house per flock on their electricity cost and a typical bulb replacement effort only costs $400 to $500 per house. Thus, full payback on bulb replacement is realized in about 2 flocks; for every flock thereafter, the grower keeps his $200 to $250 in savings in his wallet.

Additionally, bulb life of CCs & CFLs is much longer than incandescent; typically 20-25 times longer for CCs and 15-18 times longer for CFLs. Longer life of CCs and CFLs more than compensates for their higher cost and also reduces labor time in replacing burned-out bulbs.

We have encountered so many different light circuit arrangements (circuit layout, receptacle spacing, bulb wattage, etc.) on farms across the Broiler Belt, it is impossible to use a “cookie-cutter” approach, but most local complexes only have several such arrangements to consider, so on a local complex level it is fairly simple to develop workable lighting scenarios for the 4 or 5 arrangements they encounter. Again, the overall goal is to use cold cathode bulbs down the dimmer circuits, and supplement them with compact fluorescent bulbs down the center.

Thanks to the following for their support of Extension poultry engineering, economics and management programs at Auburn University:

Diamond

Aerotech/Munters	888-335-0100
Agrifan	800-236-7080
CANARM Ltd.	800-267-4427
Cumberland	217-226-4401
EXPERT CONTROLS	877-926-2777
Hired Hand, Inc.	800-642-0123
Poultry Litter Treatment-PLT	800-379-2243
Reeves Supply	888-854-5221
The Dow Chemical Co.	www.styrofoam.com
VALCO	888-345-8956

Platinum

DIVERSIFIED / ROTEM	800-348-6663
Pro-Tech, Inc.	www.pro-techinc.com

Gold

Atlantic Power Solutions	800-253-1528
Chore-Time	574-658-4101
LATCO	479-824-3282
Porter Insulation Products	800-999-0430

Silver

Aviagen	800-826-9685
CoolAir	904-389-1469
Dandy	800-222-4166
Detroit Radiant Products Co.	www.reverberray.com
Double L Group	800-553-4102
DuPont Animal Health Solutions	mark.a.hux@usa.dupont.com
Ellison and Ellison	770-427-8929
Federal Land Bank Assoc. of North Alabama	888-305-0074
First South Farm Credit	800-955-1722
IVESCO	800-643-3064
J&R Builders	205-594-5994
Lewis Brothers	912-367-4651
Multifan/Vostermans Ventilation, Inc.	800-458-5532
Space Ray	800-438-4936

U.S. Poultry & Egg ASSOCIATION

NPTC National Poultry Technology Center AUBURN UNIVERSITY

AP&EA

ALABAMA COOPERATIVE Extension SYSTEM

The Poultry Engineering, Economics and Management Newsletter provides up-to-date information on topics of interest to poultry production personnel, focusing on most effective and efficient uses of modern technology and equipment, with a special emphasis on economic implications. The Newsletter is published six times a year, or as needed to address emerging or special issues. Contact: Jess Campbell, National Poultry Technology Center, 226 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-3546, fax (334) 844-3548, jesscamp@aces.edu. Published by:

Jim Donald, Professor and Extension Engineer

Jess Campbell, Program Manager, National Poultry Technology Center

Gene Simpson, Professor and Extension Economist

Kenneth Macklin, Assistant Professor and Extension Poultry Scientist