Energy Savings with Heat Pads and Lighting

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▪ Heat Pads vs. Heat Lamps

Summary

The results from three R&D projects show that there is no statistical difference in weight gain and mortality between piglets raised with heat lamps and piglets raised with energy efficient heat pads.

The heat pads provide a comfortable heated zone for the newborn piglets and piglets tend not to seek warmth from the mother sow which reduces crushing losses. Head pads offer a large comfort area that minimizes piglet piling.

Research conducted at the Glenlea Research Station of University of Manitoba, in comparing heat pads vs. the combination of heat pads and 100 watt heat lamps for the first 4 to 24 hours, revealed that there was no statistically significant difference in weight gain and mortality, however, the heat lamps helped dry off the birth fluid.

Heat lamps typically consume 1279 kWh per crate while energy efficient heat pads consume 383 kWh, thus a saving of 896 kWh per crate per annum in typical commercial farrowing operations. At 5¢/kWh, this is equivalent to $45/annum. There is an additional saving of 1.5 heat lamps per farrowing crate per annum. At $10/lamp, this translates to a saving of $15/annum.

Discussion

In the early 1990's some utilities were providing incentives for producers to switch from 250 watt reflector type heat lamps to 175 watt par heat lamps. Manufacturers of heat pads were also promoting energy efficient heat pads. As a result, during the period 1990 to 1994 research was performed at Brandon Research Station of AAFC (Agriculture and Agri-Food Canada) to

evaluate piglet performance in terms of weight gain and mortality by comparing piglets raised on heat pads vs. heat lamps. The results showed that there was no statistical difference in piglet weight gain and mortality between the two heating methods.

As more producers were switching from heat lamps to heat pads, a number of them enquired on the benefit of heat pad and heat lamp combination for the first 4 to 48 hours vs. heat pads only. As a result, two years of research was performed at Glenlea Research Station of University of Manitoba. In the research, a 100 watt par heat lamp was used in combination with a heat pad for the first 4 to 48 hours.

The research results concluded that there was no statistical difference in weight gain and mortality between pad-lamp combination and pad alone. However, the heat lamps helped dry the birth fluid off the newborn piglets.

Figure 1. Farrowing rooms using either heat lamps or heat pads.

Control room equipped with 175 watt heat lamps

Test room equipped with heat pads 66 watt per crate.

In 2005, further research was performed with the Puratone Corporation of Niverville, Manitoba, for a commercial 3100 sow farrow to isowean facility. Two farrowing rooms each with 44 crates were selected, one of the rooms was equipped with 22 double-size heat pads (130W, or 65W per crate), and the other room was equipped with 44 infrared lamps (175W) (**Figure 1)**. The results are summarized in **Table 1**.

Table 1. Mortality and average daily gain of piglets recorded in the pad and lamp rooms.

	Mortality, %		Average Daily Gain, g/day	
Cycle	**Pad Room**	**Lamp Room**	**Pad Room**	**Lamp Room**
1	10.5	11.0	268	236
2	14.5	7.3	239	223
3	8.8	10.8	256	231
4	8.6	13.1	221	229
5	11.7	13.3	-	-
Average	10.8	11.1	250	230
SD	2.4	2.4	20	5

The conclusion was that there was no statistical difference in weight gain and mortality between the lamp and pad rooms. The heat lamp consumed 1279 kWh per crate and the heat pad consumed 383 kWh per crate.

In the winter, the trial room with heat pads only had a higher relative humidity than the test room with heat lamps (66% vs. 55%).

Power Consumption

In farrowing room with 44 crates, heat pads would reduce power consumption by 70%.

- **44 Heat Lamps** (175 watt) - power consumption = **56,276 kWh/annum**
- **44 Heat Pads** (66 watt) - power consumption = **16852 kWh/annum**

Benefits of Heat Pads

- The saving of 896 kWh of energy per crate per annum vs. heat lamps is equivalent to $45 at 5.0¢/kWh.

- An additional saving on replacement of 1.5 heat lamps per annum, or equivalent to $15 at $10 per heat lamp.
- Heat pads provide a larger comfort area so that piglet piling is minimized. Heat pads protect the piglets by blocking drafts rising through the slat floor of the farrowing crate.
- Heat pads eliminate the potential fire hazard of heat lamps, broken lamps, the waste of natural resources in burned out lamps, and the need to replace heat lamp sockets.
- Heat pads require less electrical maintenance than heat lamps, can be washed down with a high pressure washer, and have an expected life of up to 15 years compared to two-thirds of a year for typical heat lamps.

Table 2. Incentive to replace heat lamps with heat pad (Manitoba Hydro).

Watt(s)/crate	$/crate
0 -75 watt	50
76 -100 watt	30
> 100	no rebate

Economics

Heat Lamp Replacement

7500 crate hours ÷ 5000 hour lamp life	= 1.5 lamp replacement
1.5 lamp x $10	= $15/crate/annum

Energy Charge

Heat Lamp	
1279 kWh @ 5.0¢/kWh	= $64/crate/annum
Heat Pads	
383 kWh @ 5.0¢/kWh	= $19/crate/annum
Saving	**= $45/crate/annum**
Plus heat lamp replacement	= $15/crate/annum
Total Savings	**= $60/crate/annum**

Simple Payback for Renovation

Cost of heat pad per crate	= $125.00
Plus Installation	= $25.00
Less rebate, where applicable	= - $50.00
Net cost	= $100.00
Simple Payback	**$100÷60 = 1.7 years**

Conclusion – Heat Pads vs. Heat Lamps

Heat pads are an effective method for swine creep heating and research has indicated that there is no statistical difference between weight gain and mortality compared to heat lamps.

There is no statistical difference between weight gain and mortality between heat pads and the combination of heat pads and 100 watt par heat lamps for first 4 to 48 hours.

Heat pads save 896 kWh per crate equivalent to $45/annum at 5.0¢/kWh.

There is a further saving of $15 per annum for heat lamp replacement at $10/lamp.

▪ Lighting

Summary

Table 3. Recommended Illumination levels.

Type of Housing	Light Levels		Photoperiod, hrs/day	Comments
	Lux	Footcandle		
Breeding/Gilts	>100	>10	14-16	Necessary for estrus cycling
Gestation	>50	>5	14-16	To assist missed cycles, bring on estrus again
Farrowing	50-100	5-10	8	If no heat lamps, light in room 24 hours per day
Nursery	50	5	8	Light in room 24 hours per day
Grower-Finisher	50	5	8	

Source ASAE EP 344.3 January, 2005

In-barn research shows that gilts benefit from exposure to 14-16 hours of light each day. Gilts reach puberty sooner, have prolonged estrus and farrow more pigs per litter than gilts raised in reduced light conditions or in the dark.

Studies also show that differences between incandescent, fluorescent and metal halide lighting do not appear to have any effect on hog performance.

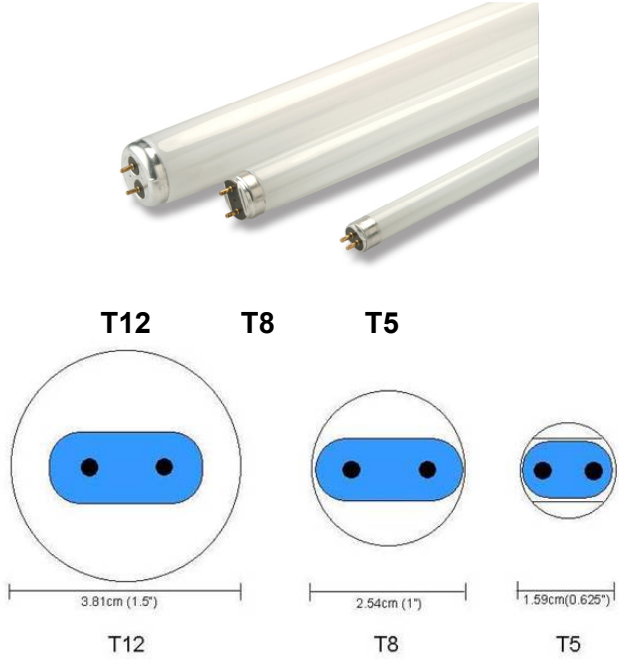
T8 Fluorescents

T8s are slim, high-efficiency fluorescent lamps that generate more light per watt than T12 conventional lighting (**Figure 2**). Because they are 20-30 per cent more efficient than T12s, T8s help trim energy costs.

The design and layout of T8 systems is the same as for T12s, for renovations as well as new construction. Wider product ranges for T8s mean that designs more closely match lighting requirements.

Compared with incandescent lamps, T8s use up to one-fifth the electricity, last ten times longer, and require less maintenance, contributing to lower labour and maintenance costs.

Figure 2. Types of fluorescent lamps



Although lamp pins are identical for T8s and T12s, converting to T8s will require new electronic ballasts. The new ballasts improve power quality, and create quiet and virtually flicker-free generation.

Fluorescent Ballast:

- T12 Magnetic ballast 77 watts
- T8 Electronic ballast 59 watts

Note – as of April 1, 2010, T12 magnetic ballasts will no longer be available for retrofitting existing fixtures

By converting T12 magnetic systems to T8 electronic systems before April 1, 2010 incompatibility problems between lamps and ballasts can be avoided. Incompatibility can affect lumen output, brightness and maintenance life of lamps and ballasts.

Some utilities provide incentives for lighting in swine barns.

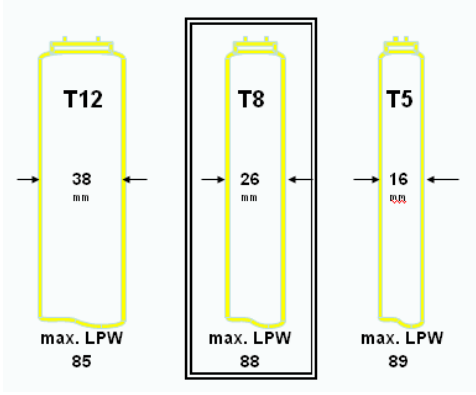
Table 4. Incentives for replacing fluorescent T12 with fluorescent T8, *Manitoba Hydro Power Smart Commercial Lighting Program*

Renovation	Standard Ballast	Premium Ballast
New fixture installed	$30	$35
Replace ballast in T12 fixture with electronic ballast and T8 lamp	$15	$20

Table 5. Typical Lamp Characteristics

Lamp Type	Typical Efficiency lumens/watt	Rated Average Life, hours
Incandescent – 100 Watt	15	750 – 2,000
Compact Fluorescent	60	12,000
T8 Fluorescent – 4 foot	88	20,000 +
T5 Fluorescent – 4 foot	89	20,000
T5 HO Fluorescent – 4 foot	82	20,000
Metal Halide Pulse Start - 175-watt	81	15,000

Figure 3. Development of Linear Fluorescent Lamps with High Efficiency



T8 is the most economical for barns

Mounting Height

T8 lighting is generally used for mounting height of 12 feet or less.

For mounting heights of 12 feet or more T5 lighting or pulse start metal halide lighting may be used.

T5 Lighting

- The “T” represent lamp shape-tubular.
- The number following represents lamp diameter in eighths of an inch. A T5 lamp has a diameter of 5/8”.
- A T5 lamp has a miniature bi-pin base, while T8 and T12 lamps use medium bipin bases.

Compact Fluorescent Lighting

Compact fluorescent lamp and ballast systems provide good energy efficiency and are easily retrofitted into incandescent fixtures. However the shorter equipment life and higher cost to replace lamps and ballasts compared to T8 fluorescent systems increase operating costs.

Sealed screw in lamps must be used for barn environment.

Electronic Ballasts

Electronic ballasts are tested for total harmonic distortion by Manitoba Hydro Power Smart Commercial Lighting Program. Those meeting specifications are listed in the Programs Eligible Product list.

Standard and premium ballasts are classified according to total harmonic distortion levels.

Total Harmonic Distortion, Maximum

Standard = 19%

Premium = 10%

For swine barns electronic ballasts should be potted to reduce temperature and to protect them from the corrosive barn environment.

Instant start ballasts are recommended for swine barns as they reduce energy consumption and are recommended for starts three hours or more at a time.

Metal Halide Lamps - Pulse Start vs. Probe Start

Pulse start metal halide lamps are more energy efficient than standard (probe) metal halide lighting. They provide:

- • energy savings – up to 20 per cent more light per watt
- • lower maintenance costs – usually longer life, and
- • produce a whiter light for better color rendition

Metal halide is suitable for ceilings of 12-feet or higher.

Conclusions - Lighting

Common T12 fluorescent lamps should be replaced with T8 lamps because of their 20-30% lower operating cost, longer lifespan and compatibility with existing fixtures. Incentives available, in some locations, for the necessary replacement of the T12 magnetic ballast with the T8 electronic ballasts significantly reduce the costs of conversion.