



**Environmentally-Friendly, Energy-Efficient  
Radiant Floor System (*Heating & Cooling*)**

---

**Poultry-Rearing Alternative Environmental System**

*(With or without optional thermal solar system)*

***Farm Pilot Project Coordination, Inc.***

***"Why Thermochemical Conversion Is Being Considered for  
Nutrient Capture in the Chesapeake Bay Watershed"***

***March 24, 2011***

**James L. McNaughton, Ph.D.  
Chief Scientific Officer  
AHPharma, Inc.  
Salisbury, Maryland  
Office: 443-235-6539**

***AHPharma***, Inc.



## ***DMV Future Rearing Conditions***

---

### **DMV future *chicken rearing environment* must be different:**

- Bay Restoration is forcing the DMV poultry industry to reduce manure land applications.
- Grower/worker/animal humane health are growing public concerns.
- *Salmonella* & *Campylobacter* control continues to be a major issue.
- Energy cost continues to be a major obstacle to grower profits.

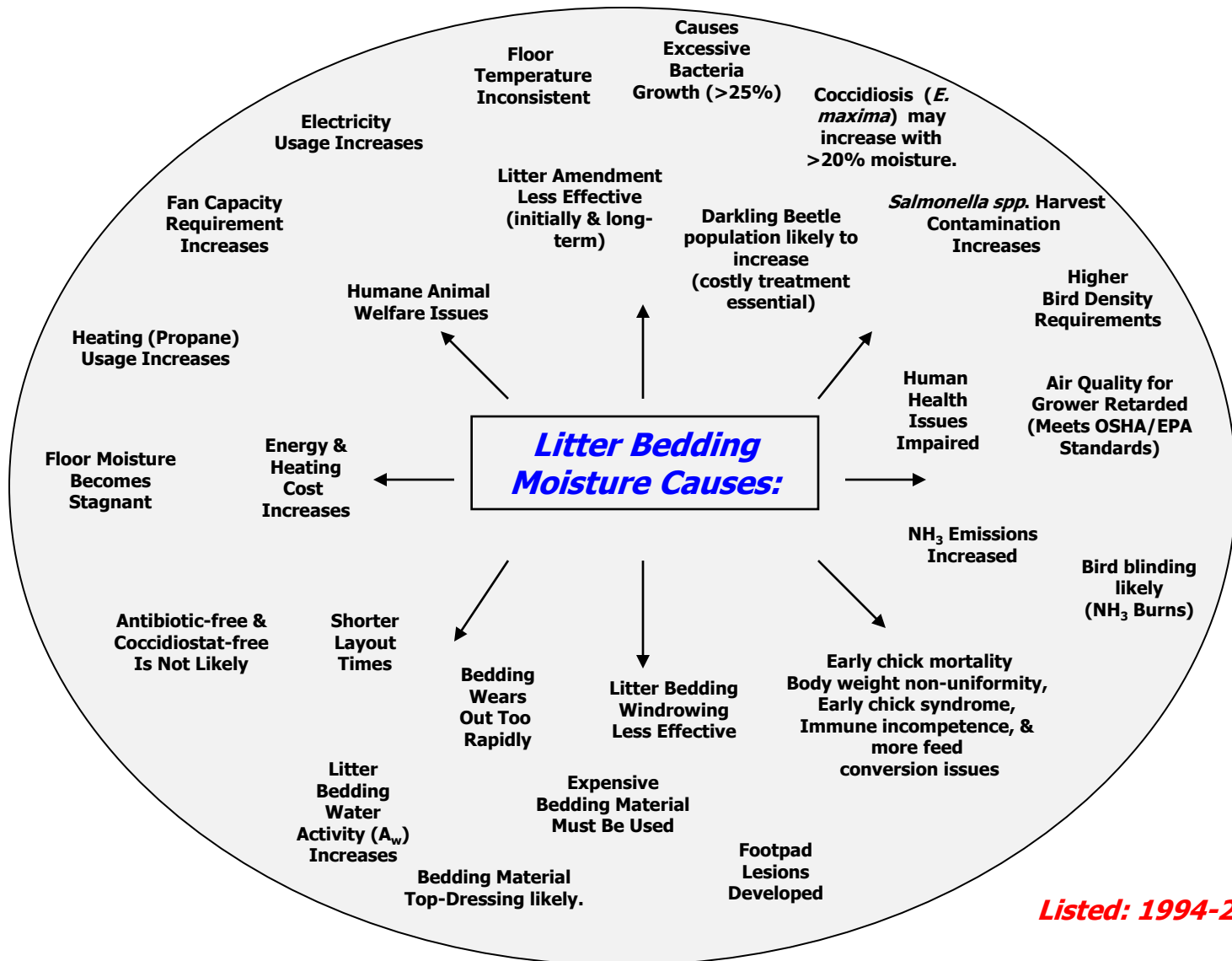


## ***Animal & Human Waste (Maryland)***

---

- **Maryland Manure Waste =**
  - 325,000 tons from 292 million birds annually in 2,500 houses.
  - Manure contains 3,800 to 4,600 BTUs per #.
  - Manure available energy: up to 150M BTUs per growout.
  - Each growout needs about 55-125M BTUs per flock to heat the flock.
- **Maryland Human Waste (Class B Sewage) = 700,000 tons**
  - 50% is wet for subsoil injection
  - 50% surface use
- **Other States/DC Waste Usage within Maryland = ~100,000 tons**  
(mostly subsoil injection).
- **Where Maryland waste is used:**
  - Animal Waste (325,000 tons):
    - Land Application (75% or 245,000 tons)
    - Transported outside of MD (25% or 80,000 tons)
  - Human Waste (800,000):
    - Surface Land Application (30% or 210,000 tons) prior to crop production
    - Sub-soil Land Application (30% or 590,000 tons) frozen & crop production
    - Transported outside of MD (~15%)
    - Placed in landfills (~25%)
    - Other uses (~5%)

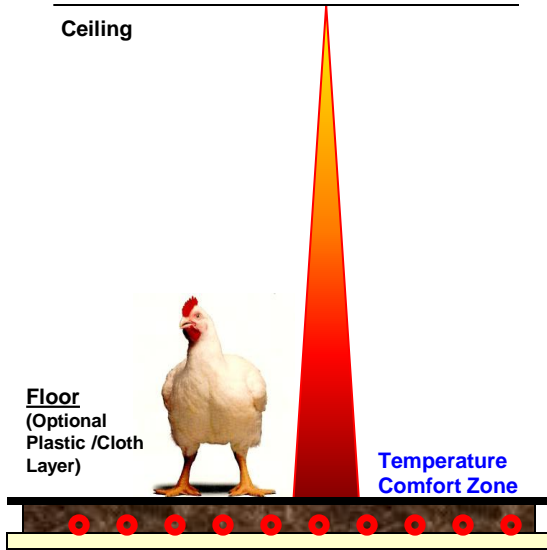
## **Influence of Litter Moisture On Profitability & Health Factors**



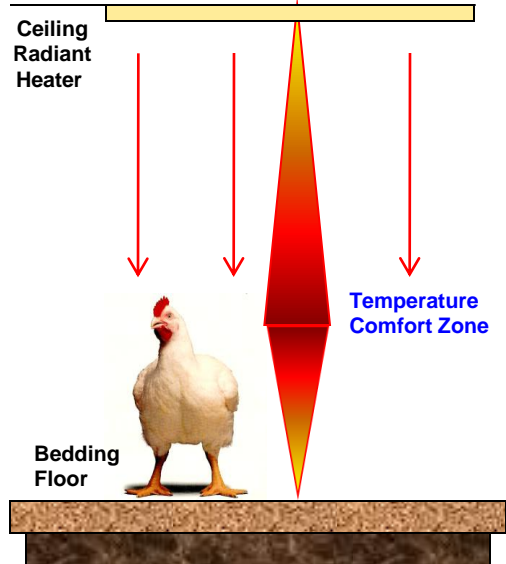
**Listed: 1994-2010**

# Where is *heat IDEALLY* required?

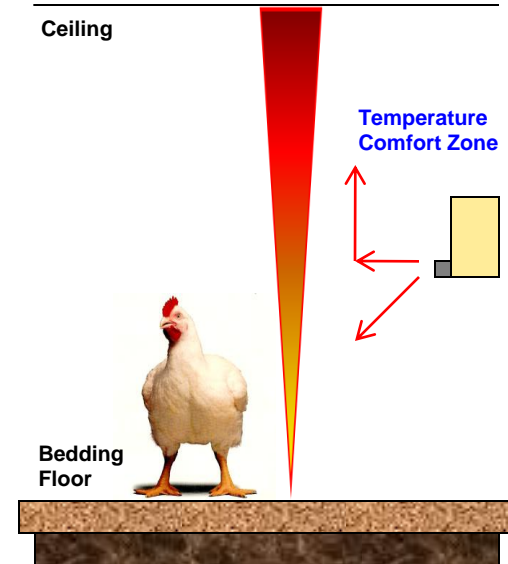
### Radiant (Heated/Cooling) Floor



### Ceiling Radiant Heater



### Forced Air Oven Heating System



*Semipalmate feet* have partial webbing present only at the base of the front toes, an adaptation that is useful for occasional swimming or walking on soft surfaces, found in domesticated breeds of chickens.

The legs and feet of waterfowl play an important role in *thermoregulation*.

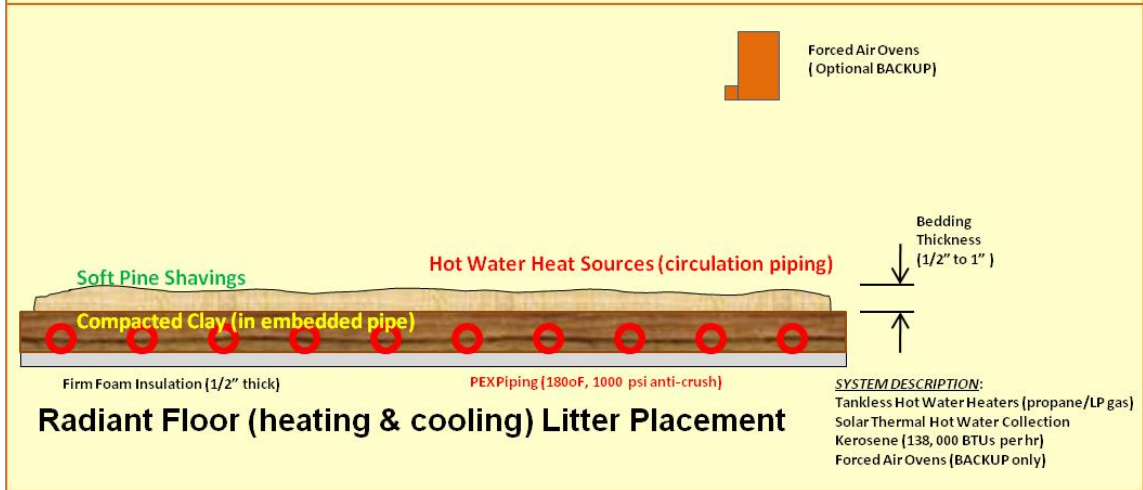
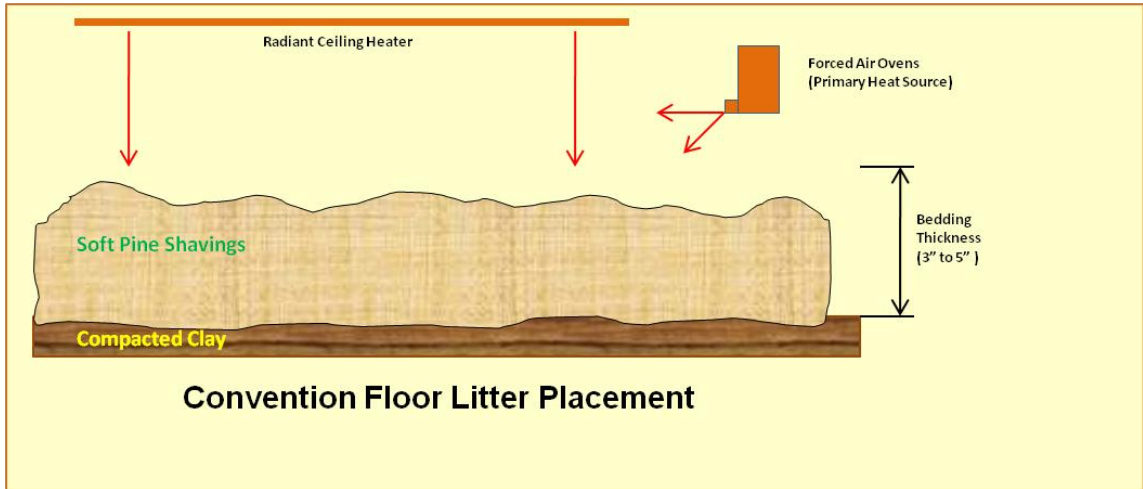
**COLD WEATHER:** To conserve heat, waterfowl reduce the amount of blood flowing to their feet by constricting blood vessels in their legs.

**EXCESS HOT WEATHER:** If provided cool feet, chickens can also release excess body heat through their feet.

## Normal Heated Floor Construction (PEX piping zoned under feeders/waterers)



# Heating System Cross-Section Design Comparison



**Heated Floor Design (AHPharma Farm #2)**  
**(Solar collector placement)**

**Solar water  
collectors are  
placed facing the  
Southern  
hemisphere.**

**Maximum sun  
exposure is  
South direction at  
38-43°**



## ***Mechanical Equipment (now manufactured as one unit)***



***Tankless Hot Water Heaters & Circulation Pumps***



***Controllers & Water Filtration (if applicable)***



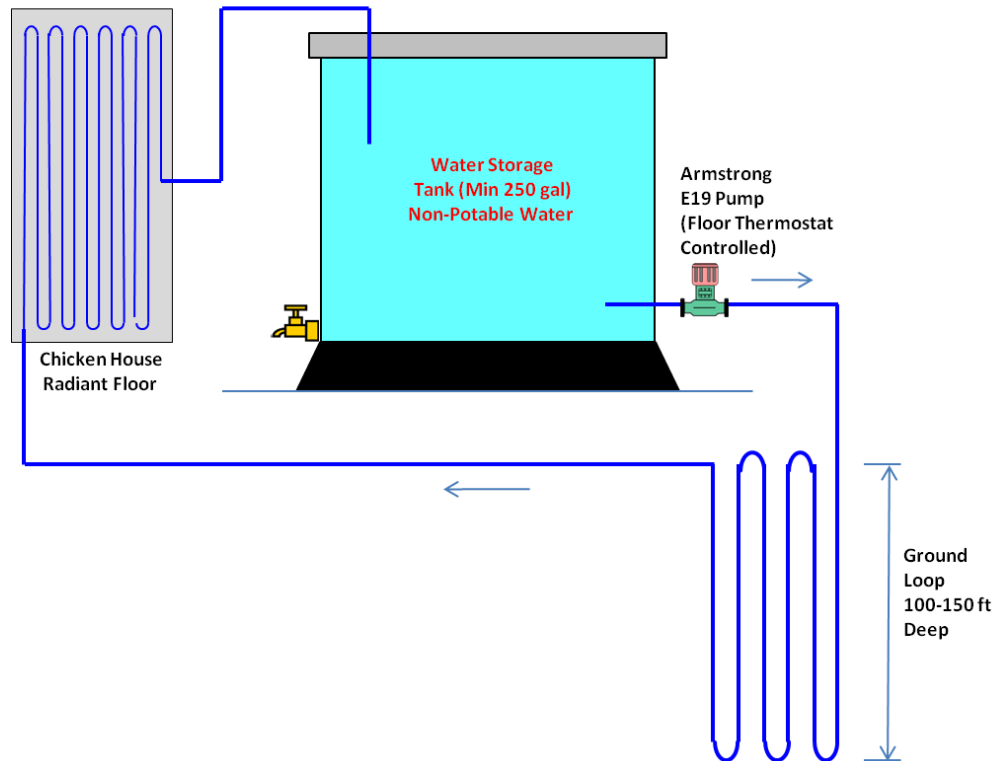
***House, Water & Solar Temperature Controllers***

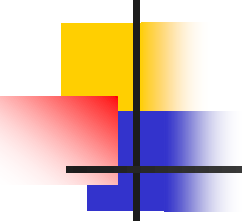


***Tankless Hot Water Heaters***

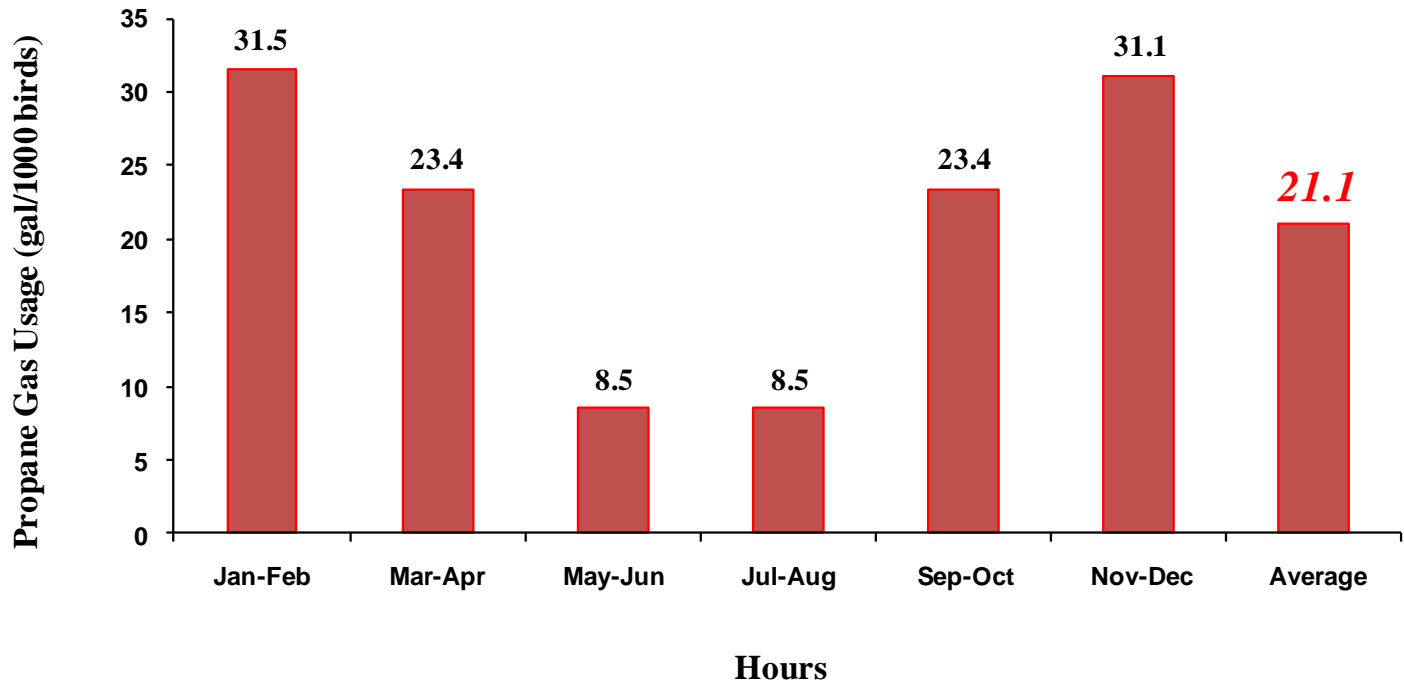
# Radiant Floor Cooling System

UMES MIPS #4509 May 2010

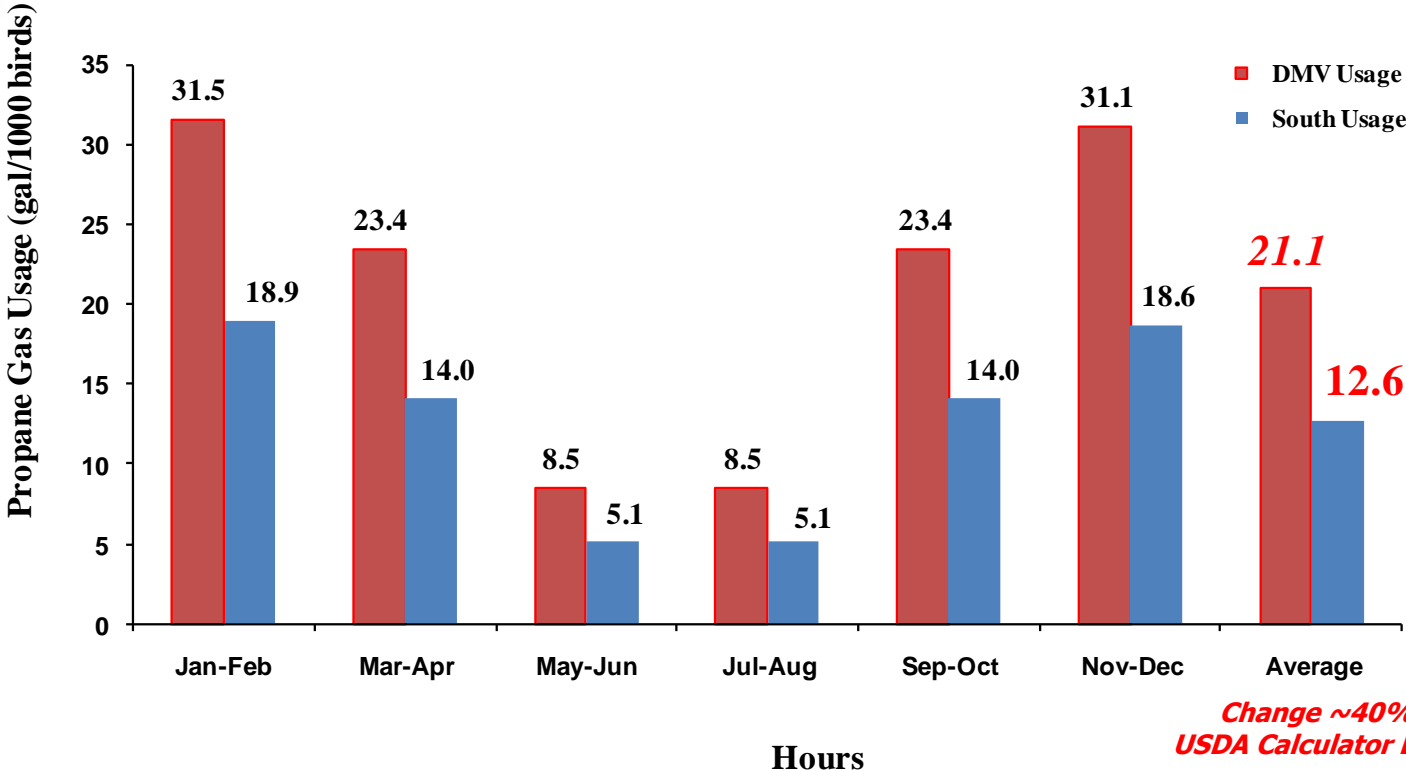




## DMV Propane Gas Usage Large-Bird Flock 2010-2011



# USA Propane Gas Usage Large-Bird Flock 2010-2011



# ***Advantages of Radiant Floor vs. Conventional Heating Systems***

***(nine growout data collection)***

<b>Grower Advantage</b>	<b>Integrator Advantage</b>
Increased grower profit (return on investment <4 years)	Improved bird health
Consistent heat source	Reduced health drugs & growth promoters
Reduced summer floor heat (12-15°F change)	Decreased heat energy cost
Increase body weight (0.36# per bird)	Darkling beetle <i>Salmonella</i> eliminated
Decreased heat energy cost	Body weight uniformity
Improve feed conversion	Reduced electrical cost
Human health improvements (air quality)	
Reduced ammonia levels (35 vs. 4 ppm)	
Reduced ventilation/energy cost	
Reduced litter bedding cost	
Windrowing eliminated	



## **Research interest in Biothermal Energy:**

---

- **Dry heat source will allow completely control of litter moisture**
- **Ability to heat both air and water (via heat exchanger)**
- **Eliminates need for manure land application and/or manure transport**
- **Ability of farm to become a self-sustaining unit**
- **Reduces ventilation dependence**
- **Combined with radiant floor system will provide year-round comfort**
- **Helps save the poultry industry in Maryland.**

***Thank You !***