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Reducing the Environmental Footprint of Swine Buildings (Designing a Green Pig Barn)

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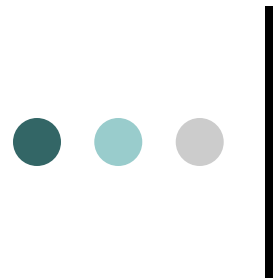
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Green Pig Barn Project

- **MN Pork Board (MPB) funded**
 - **In first year of a 2 year project, 2nd year funding pending.**
- **Focus on “Midwest” pig finishing barns (baseline or reference is the double-wide, deep-pit finishing barn)**



Green Pig Barn Project

- **Objective:**

- **Develop new pig finishing building design for Midwestern pork production, based on building design criteria that reduces the housing system's environmental footprint (lowers ENERGY & water usage and airborne emissions by 50%) while maximizing utilization of manure/waste products .**



Present Building Designs

- Limited “system design or engineering” in current buildings
- Only components are “engineered”, rarely is the housing system “Integrated” into a single design
 - Building frame
 - Pen layout and partitions
 - Ventilation
 - Manure system
 - Feed and water systems



Green Pig Barn Project

○ Summary

- Design a finishing barn housing system based on research results or scientific and/or engineering principles .
- Integrate all housing components into a single design with emphasis on **energy** and production efficiency (reduced environmental footprint)
- Design would be for the Midwestern US

● ● ● | Environmental Footprint

- **Energy**

- Fossil Fuel (LP, electricity, diesel, etc)
- Non-Fossil Fuel (feed, etc)

- **Water**

- **Odor**

- **Particulate Matter (PM)**

- **Gases**

- Hazardous (H_2S and NH_3)
- GHG (CO_2 , CH_4 , N_2O)





Evaluation of Design with Simulation Model - Staldvent

- Use Danish computer simulation model STALDVENT (predicts pig growth, feed & energy use plus some emission rates)
- Staldvent will be validated with existing pig growth, energy, & emission data using existing finishing barn data from MN and IA.
- **Once validated, this model will be used to compare the performance of the new pig barn design with baseline data from reference double-wide, deep-pig barn**



Possible Areas to consider

- Direct Energy Cost of Production
 - 2-5% of pig production cost (UMN Farm Financial Management)
- Indirect Energy Cost of Production
 - Feed efficiency, rate of gain
- Emissions
 - Odor
 - Hazardous gases
 - GHG gases
 - PM





Direct Energy Costs

- Fan performance (10% annual savings)
 - Fan type
 - 9 inch fans 5 cfm/Watt 53" fans up to 31 cfm/W – 6 times the efficiency
 - Pressures
 - 10% drop in performance with pressures from 0.05 to 0.1
 - Exhaust cones and shutters
 - Ventilation strategy
 - Maintenance
 - Cleaning
 - Belt tension

Recent project suggests typical over ventilation in summer by 50%





Direct Energy Costs

- Heat Lamps (wean to finish facilities)
 - Up to 20% reduction in energy use with alternative lamps, placement and timing
- General Lighting
 - Efficient bulbs and controls





Direct Energy Costs

- Heated buildings in cold/cool weather
 - Reduced ventilation rates
 - Heater efficiency
 - Building Insulation
 - Environmental Control systems (e.g. temperature setpoints and heater on-off time)



● ● ● | Indirect Energy Costs

- Pig performance
 - Improved building climates impact on pig performance – feed efficiency results in both cost savings and energy savings – less crops grown for same production
- Manure Handling
 - Less manure and/or water means less energy to apply manure
- Reduced amount of building materials






Outside of the Box Ideas

- **Building dimensions**
 - **Similar to cross ventilated dairy barns**
- **Ventilation modifications**
 - **Inlet and exhaust locations**
 - **More fan staging**
 - **Control on CO₂ vs temperature**





Annual Energy Use for 600 head finisher (1800) for last 3 yrs*

○ Electrical Energy

- 2006 = **20,211** kWh or **11.23** kWh/pig prod
- 2007 = **17,402** kWh or **9.67** kWh/pig prod
- 2008 = **16,888** kWh or **9.38** kWh/pig prod

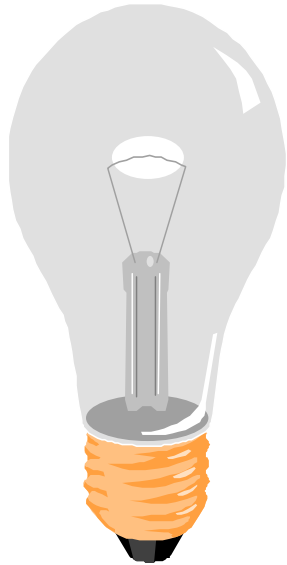
○ LP Gas

- 2006 = **705** gal or **0.39** gal/pig prod
- 2007 = **1,175** gal or **0.65** gal/pig prod
- 2008 = **1280** gal or **0.71** gal/pig prod

* from Bob Koehler (SW MN)



Questions?



Lights Please

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