Roadblocks to Adopting Energy Efficient Practices for Environmental Control of Livestock and Poultry Facilities

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Knowledge is Power

- Discover
- Develop
- Use
- Disseminate

Systems approach

- Behavior based on knowledge
- Components
- Interactive processes
- Boundaries
- Inputs & outputs
- Environment

Environmental control by mechanical ventilation

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Purpose of ventilation

1. Exchange air
2. Maintain appropriate environment
3. Uniform conditions
4. Economical
5. Year-round

Ideal ventilating process

- Outside air enters
- Mixes
- Picks up heat, moisture, airborne contaminants
- Moist heated air is exhausted

Ventilating systems affect:

- Air temperature
- Moisture level
- Air temperature uniformity
- Air speed across animals
- Airborne dust & disease organism levels
- Odor & gas concentrations
- Combustion fumes from unvented heaters
- Moisture condensation on surfaces

Roadblocks to adopting energy efficient practices

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Small energy costs relative to total production costs

	Energy cost as percent total production
Dairy	2.5 %
Farrow to wean	3.3 %
Wean to finish	1.4 %

FINBIN 2004, University of Minnesota

Feed versus Fuel

- Feed consumption depends on temperature.
- With more environmental control, feed consumption better controlled.

Energy use is rarely measured

You can't manage what you can't measure

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Environmental control is complex

System elements interact

Environmental conditions impact animal

- Health
- Well-being
- Production
- Reproduction
- Behavior

Air temperature

- Species
- Age
- Target growth rate

Temperature zones

	Nominal loss	Optimum
Calf	7 to 27 C	12 to 25 C
Cow	0 to 25 C	5 to 15 C
Nursery pig	25 to 27 C	22 to 30 C
Pig (100 kg)	10 to 20 C	15 to 17 C

Hahn, 1985

Moisture

- Moisture control is critical in animal facilities
- Relative humidity 50 to 70%
- Minimal condensation

Air temperature and moisture interactions are complex.

Appropriate environment

- Air Quality
  - Gases & Particulate matter
- Air speed = drafts
  - Minimal in cold weather
  - Mixing in warm weather
- Uniform conditions
- Economical

Year-round

- Winter - cold weather
- Summer - hot weather
- Mild weather
- Wet weather

Negative-pressure ventilating system

- Exhaust fans
- Air inlets
- Controls
- Heaters
- Evaporative cooling

New facilities are lumpy purchases

New practices must

- Work effectively
- Be reliable
- Minimally impact management practices
- Be economical

Show me!

- Independent research
- In the field

Progress

- Integrated programmable controllers
- More sensors & computers
- Fan performance & efficiency data
- Vacuum pump variable speed drives
- Lighting

Challenges

- Tighter environmental control
  - Tighter tolerances
  - More sensor inputs
- Skilled people
- Air emissions control

Skilled people

- Large operations
  - Specialized employees
  - Invest in technology
- Small producers
  - Consider consultants or service contracts

Energy conservation for environmental control of livestock and poultry facilities

- Is important but . . .
- Part of a ventilating system
- Occasional investment
- Must be effective, reliable, & economical

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