

Biomass Heating in the Commercial Greenhouse: Is it worth it?

Stacy Adams, Firth Flower Farm

High Tunnels & Greenhouses, the difference is . . .

- When heat is introduced, the tunnel is recognized as a greenhouse.

Why . . .

- Growers may want to extend their growing season earlier to have product available for early markets, heating may then become necessary.

Heating methods . . .

■ Unit Heaters

- Easiest to introduce
- Equipment inexpensive
- Propane or natural gas



■ Boiler Units

- Significant investment
- More uniform heating control

Greenhouse Heating Needs

- 22' x 96' Hoop style greenhouse



20 MPH Wind	Single Poly Cover	Double Cover
30°F inside/outside	77,000 BTU	54,000 BTU
60°F inside/outside	157,000 BTU	110,000 BTU

Greenhouse Heating Needs

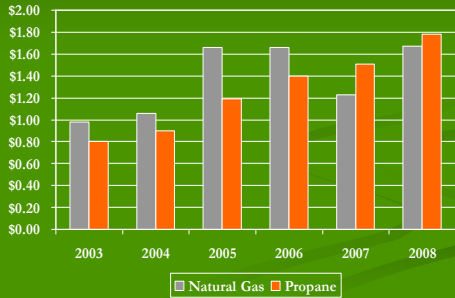
- 30' x 144' Hoop style greenhouse



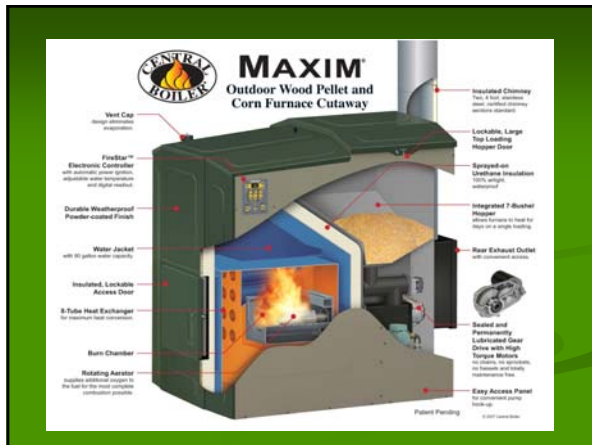
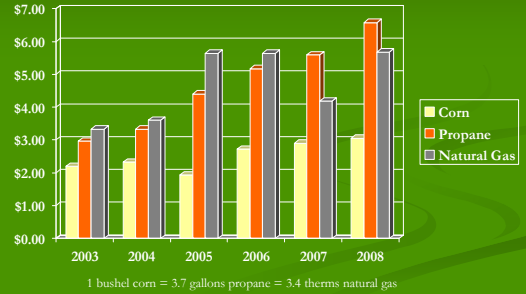
20 MPH Wind	Single Poly Cover	Double Cover
30°F inside/outside	163,000 BTU	114,000 BTU
60°F inside/outside	333,500 BTU	235,000 BTU



Heating Fuel Price History



Fuel Price Comparison



Biomass Heating Systems

- Forced air unit
- Flexible fuel
- Affordability
- Suitable in harsh environments



Equipment Selection

- Temperature stability
 - Large heat demand at dusk
 - Solar heat gain during day
- Humidity control
 - Reduction in diseases
- Interior air quality concerns
- Plant production issues



Equipment Operation

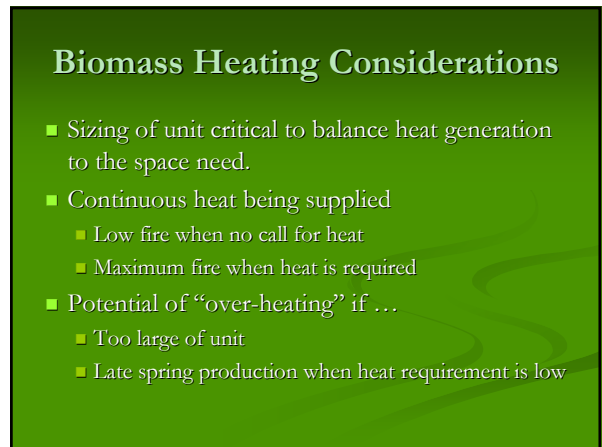
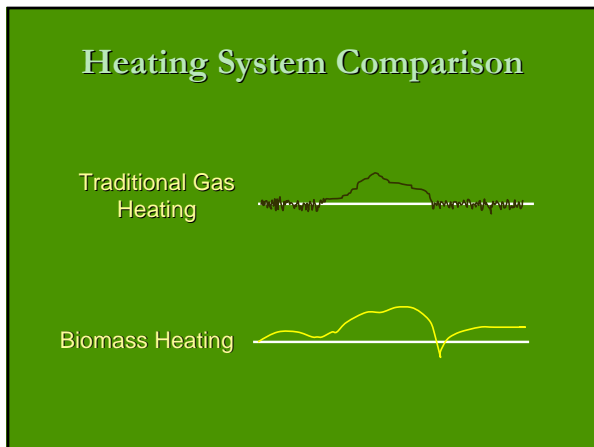
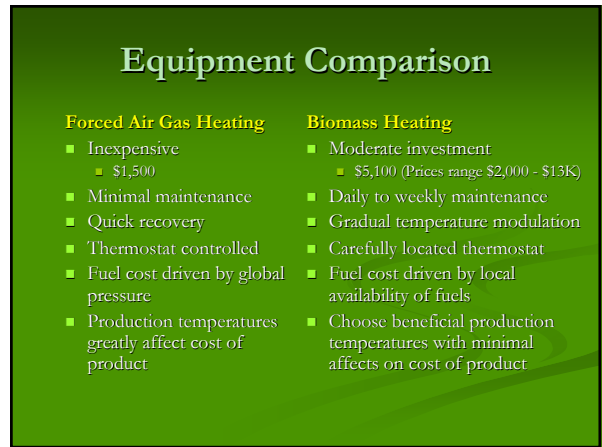
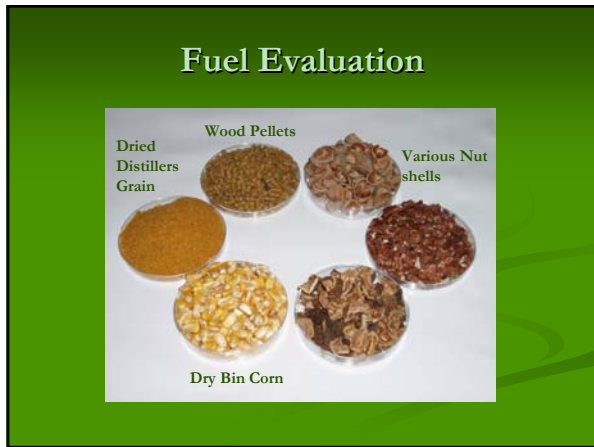


Intake & Firebox



Combustion blowers & screw augers





Operational Labor Cost

(15 week heating season)

Equipment monitoring: 1.75 hrs/wk
 Biomass loading: .5 hrs/wk
 Burn pot cleaning/firing .75 hrs/wk
 3 hrs/wk x 15 wks x \$10.00/hr = \$450

Total Labor Cost \$450



Projected Fuel Use 350 bushels x \$3.05 = \$1,068
 Operational Labor Cost = \$ 450
Total Energy Cost (season) = \$1,518

Equipment Investment

Biomass Furnace (300,000 btu) \$5,100
 Bulk bin (used 235 bushel) \$250
 New utility auger and motor \$350
 Chimney \$240
Total equipment costs \$5,940

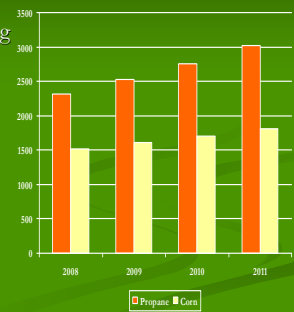


Heating Expense Comparison

- Propane Heating Cost \$2,313
 - Lock-in price of \$1.779/gallon
- Biomass Heating Cost \$1,519
- **Savings \$ 794**
- Equipment
 - Biomass Furnace \$5,100
 - Propane Unit Heater \$1,500
 - Difference \$3,600

Return on Investment

- Propane prices increasing ~ +10% annually
- Corn prices moving upward ~ +6% annually
- \$3,600 equipment cost difference
- **Returned in savings within 44 months**



Contributors



Research Team

Stacy Adams, owner Firth Flower Farm
 Dr. George Meyer, University of Nebraska, Biological Sciences Engineering
 Dr. Jay Fitzgerald, University of Nebraska, Agronomy & Horticulture
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