CERTs: Biomass for Poultry

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Hillcrest Restaurant
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Road Map

- What is CERTs?
- MN Poultry in general
- Project & Funding
- Data & Economics
- Bird health
CERTs: Minnesotans Building a Clean Energy Future

Mission: We connect individuals and their communities to the resources they need to identify and implement community-based clean energy projects.
How Does CERTs Work?

- **Staff:** Regional coordinators and statewide support
- **Steering Committees:** One per region; governing body for regional team
- **Regional Teams:** Anyone can join; broad range of skills, interest, and backgrounds
## What Does CERTs Do?

<table>
<thead>
<tr>
<th>LEARN</th>
<th>CONNECT</th>
<th>ACT</th>
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</thead>
</table>
| Write blog posts & case studies  
Create educational guides  
Manage diverse web-based tools | Host events, tours, and conferences  
Help with community organizing  
Connect people to technical resources | Provide seed grant funding and more  
Deliver research-based campaigns  
Spur other statewide programs |
CERTified Campaigns

Provide clear, actionable ways to save energy

- Sharing information about poultry-specific lighting
- Guiding people through funding options soup: USDA RD, NRCS, MDA, CIP, REC...

CleanEnergyResourceTeams.org/Turkeys
Renewable Energy
Why biomass for poultry?

- Minnesota is the #1 turkey producing state.
  - 46 million yearly
  - 450 farms
- Big on chickens
  - 47 million chickens
  - 300 farms
- Mostly LP heat
Turkey Brooder Barns
- Two days to 4-6 weeks
- Barn temp is 90°F / 32°C
- Lowers by week

Finisher Barns
- Weeks 7 – 18 or 20
- Temp 75°F / 24°C
Chicken Broiler Barns (day old to 6 weeks)

Barn temp start at 93°F (34°C) and decreases weekly to 72°F (20°C) before load out at 6+ lbs

*Chickens* like it a little HOTTER
• Long, skinny barns
• 60-70 ft x 300-400 ft
• 3 MMBtus to heat a barn this size for 1 hour in cold months (avg. 1.5 MMBtu)
• Year with a hard winter can consume over 4,000 MMBtus
Project Originators

Photo Credit: Kimm Anderson, St. Cloud Times
Project History

• Original idea: Put a 1.2 MMBtu wood chip furnace on a turkey brooder barn:
  • Heat *half* with the furnace
  • Heat the other half with LP

• Went through several grant applications before the project landed

Shorter European Barn >>>
Insurance Barrier

• For the original attempt, insurer refused coverage

• Cited NFPC 211 Standard for Chimneys, Fireplaces & Vents and solid fuel problems
  • Ash disposal
  • Sparking
  • Human error
Dozens of open flame heaters over wood chips and feathers
The Viking Project

• Funded by MN Dept. of Ag’s NextGen Energy Grant (Thank you!)
• Insured by Elmdale Farmers Mutual Insurance
• Hosted by Bill Koenig
• Installed by Jim Eincyk

Photo Credit: Briana Sanchez St. Cloud Times
The Viking Project

- Mabre made 1.65 mil Btu forced air furnace
- $71,000 for shipping, tech, 15 HP blower, feed augers, stirrers, and XL hopper.
- $23,000 in ducting, chimney, 800’ polymax & labor
- $28,400 in barn construction w/ cement pad
- TOTAL $122,400 in hardware, install labor & shipping
The Viking Project

Two-story broiler chicken barn near Albany, MN
The Viking Project
The Viking Project

Control

Test
Data & Economics

• Twelve flocks across two winters - still collecting data

• Hardwoods with moisture content under 15% and chipped 2 inches or less

• Fuel blends: furniture byproduct, trim/moulding, dry white oak, recycled construction wood
Wood Chips!

- White Oak, 15% M.C. $95 ton
- Furniture Material, 8% M.C. $50 ton
- Trim/Moulding, 10% M.C. $38 ton
- Recyc. Construction, 15% M.C. $70 ton
Contracts & Incentives

- Here, farmer receives the margin between the farmer’s wood costs per flock and the fuel cost average of his peers per flock on a sq ft basis.

- Incentive design: use less or use a cost-effective alternative fuel.
$76.67/wood ton $\cong$ $0.84$ gal/LP
$49.39/wood ton $\cong$ $0.53$ gal/LP
Operability

- Labor per Flock
  - 5.6 hours filling hopper (0 with conveyor)
  - 1.0 hr cleaning cabinet and polymax tubes
  - 0.5 hr cleaning out ashes
  - 1.0 hr cleaning heat exchanger

Total 8.1 hours

One hiccup after 5 flocks: Condensate plaque on the heat exchanger tubes. Turned into hot charcoal bits in the Polymax tubes.
Ash Content

- Burns well – ash had less than 1 Btu/lb left
  - 2.8% phosphorus (P$_2$O$_5$)
  - 11.5% potassium oxide (K$_2$O)
- BUT also high in sodium oxide (Na$_2$O)
- Salts are not good for soil amendment
<table>
<thead>
<tr>
<th></th>
<th>Liq. Propane Barn</th>
<th>Wood Heat Barn</th>
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</thead>
<tbody>
<tr>
<td><strong>2016 Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Cost</td>
<td>35.49</td>
<td>35.15</td>
</tr>
<tr>
<td>Average Weight</td>
<td>6.36</td>
<td>6.28</td>
</tr>
<tr>
<td>Feed Conversion</td>
<td>1.841</td>
<td>1.823</td>
</tr>
<tr>
<td>Field Condemns</td>
<td>.61</td>
<td>.52</td>
</tr>
<tr>
<td>Livability</td>
<td>91.2%</td>
<td>90.93%</td>
</tr>
<tr>
<td>Litter</td>
<td>.75</td>
<td>.73</td>
</tr>
<tr>
<td>Effective Cost Ranking</td>
<td>124/183</td>
<td>72/183</td>
</tr>
<tr>
<td>Condemned Ranking</td>
<td>152/205</td>
<td>107/205</td>
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</tbody>
</table>
## Winter 16-17 Flock Health

### Three flock averages

<table>
<thead>
<tr>
<th>Average Results</th>
<th>LP Barn</th>
<th>Wood Barn</th>
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</thead>
<tbody>
<tr>
<td>Feed Conversion</td>
<td>1.813</td>
<td>1.787</td>
</tr>
<tr>
<td>Weight</td>
<td>5.699</td>
<td>6.422</td>
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<tr>
<td>Field Condemn Percent (heads)</td>
<td>.266</td>
<td>0.316</td>
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<tr>
<td>Livability</td>
<td>93.069</td>
<td>87.848</td>
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<tr>
<td>Effective Cost</td>
<td>37.26</td>
<td>35.39</td>
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</tbody>
</table>
### Winter 16-17 Flock Health

Three winter ’16–’17 flock rankings out of 26 barns

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</thead>
<tbody>
<tr>
<td>Feed Conversion</td>
<td>13/26</td>
<td>6/26</td>
<td>6/26</td>
<td>16/26</td>
<td>15/26</td>
<td>16/26</td>
</tr>
<tr>
<td>Weight</td>
<td>15/26</td>
<td>1/26</td>
<td>29/26</td>
<td>20/26</td>
<td>5/26</td>
<td>6/26</td>
</tr>
<tr>
<td>Field Condemn % (heads)</td>
<td>9/26</td>
<td>10/26</td>
<td>10/26</td>
<td>11/26</td>
<td>23/26</td>
<td>18/26</td>
</tr>
<tr>
<td>Livability</td>
<td>3/26</td>
<td>11/26</td>
<td>10/26</td>
<td>8/26</td>
<td>13/26</td>
<td>8/26</td>
</tr>
<tr>
<td>Effective Cost</td>
<td>17/26</td>
<td>6/26</td>
<td>12/26</td>
<td>7/26</td>
<td>10/26</td>
<td>5/26</td>
</tr>
</tbody>
</table>
Air Quality

CAVEAT

The air quality data is largely anecdotal. Long-term, scientific analysis is needed for legitimacy.
Air Quality – RH%
The sole laboratory analysis showed virtually no difference between the Liquid Propane Barn and the Wood Chip Barn.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Ammonia (NH3) in PPMv</th>
<th>Carbon Monoxide (CO) in %</th>
<th>Oxygen (O2) in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Sample</td>
<td>0.254</td>
<td>0.4</td>
<td>21.0</td>
</tr>
<tr>
<td>Propane Barn</td>
<td>0.246</td>
<td>0.4</td>
<td>20.7</td>
</tr>
<tr>
<td>Wood Barn</td>
<td>0.272</td>
<td>0.4</td>
<td>20.4</td>
</tr>
</tbody>
</table>
Flock 9 tracked air quality data on a daily basis

<table>
<thead>
<tr>
<th>Barn</th>
<th>Carbon Monoxide (CO) %</th>
<th>Ammonia (NH₃) in PPMv</th>
<th>Oxygen (O₂) %</th>
<th>Relative Humidity %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>0.19</td>
<td>0.227</td>
<td>22.7</td>
<td>56.6</td>
</tr>
<tr>
<td>Liq. Prop.</td>
<td>0.86</td>
<td>0.283</td>
<td>22.3</td>
<td>62.9</td>
</tr>
</tbody>
</table>
CERTs:
Minnesotans Building a Clean Energy Future

Learn more: Visit the CERTs website, attend an upcoming event, or connect with a member of our staff.
www.mncerts.org

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