Farm Energy IQ

On-Farm Biomass Pellet Production

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On-Farm Biomass Pellet Production
Overview

• Introduction
• Pelleting equipment
• Keys to successful operation
• Markets and uses for pellets
The Pellet Industry

• Primarily producing wood pellets
• Started as a way to use sawdust at sawmills
• Large operations – tons per hour
• Two main markets
  – Domestic – home heating (dominant market in the Northeast U.S.)
  – International – power plants in Europe, Asia
Opportunities for On-Farm Production

- Can grow feedstock – wood or grass
- Smaller equipment is available
- Produce own heating fuel or sell to others
- Buy local food, buy local energy!
Common Feedstocks
Common Feedstocks
Common Feedstocks
Common Feedstocks
Pellet Theory - Densification

- Downward pressure
- Transverse and longitudinal compression – “dynamic plug”
- Cooling/hardening
Friction resisting movement, creating back pressure.

- Maximum Back Pressure
- Lateral and Transverse Compression
- Friction resisting movement, creating back pressure
- Minimum Back Pressure

Downward Pressure of Roller
What is in Biomass?

- **Extractives** (~5% by mass)
- **Hemicellulose** (~23% by mass)
- **Lignin** (~27% by mass)
- **Cellulose** (~45% by mass)
Pellet Theory – Binding
Harvest
Storage
Storage
Grinding

1. Tub grinder
2. Hammer mill
3. Collection system
Conditioning
Pelleting
Cooling

• As it cools, the pellet dries and hardens
• Commercial facilities use cooling bins with forced air movement
• Small operations can use open air drying on racks or similar
Packaging

- Plastic, 18-kg (40-lb) bags are most common
- Must be sealed to prevent moisture uptake
- Supersacks work for bulk sales
Keys to Successful Operation
Keys to Successful Operation – Particle Size

• Measured by screen size of grinder, nominally the maximum dimension of particle
• Too small – excessive grinding energy
• Too large – difficulty passing through die
• Recommendation – use screen size no larger than diameter of die
Keys to Successful Operation – Moisture Levels

![Graph showing the impact of moisture content on pellet quality rating. The x-axis represents moisture content (%) ranging from 0 to 35, and the y-axis represents pellet quality rating ranging from 0 to 9. The graph illustrates the correlation between moisture content and pellet quality rating.]
Keys to Successful Operation – Pre-Mixes

• Start batch with pre-mix (#1) to develop dynamic plug that flows and provides back pressure
• Follow with feedstock (#2)
Keys to Successful Operation—Die Tightness
Keys to Successful Operation – Pelletizer Speed
Keys to Successful Operation – Loading Methods

• **Open hopper machines**
  – Loading the material all at once (“dumping”) works better than does gradual feed

• **Sealed hopper machines**
  – Gradual feed may be better
Keys to Successful Operation – Finishing

• Feedstock can harden and stick if left in the die to cool
• Finish each run with a weaker material that will not clog the die
• Dried distiller grains (DDGs) and soy have both proven effective
Keys to Successful Operation –
BE SAFE!

• Potential hazards include
  – Dust (inhalation, combustion)
  – Moving parts
  – Hot parts

• Dress appropriately

• Assess risks

• Act appropriately
Markets and Uses - Heat

Large, Commercial Pellet Boilers
Markets and Uses – Sorbents
Markets and Uses - Bedding
Markets and Uses - Mulch
# Example Startup Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount per Acre</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Startup Costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Costs - Equipment</td>
<td>$1,103.13</td>
<td>$44,125.00</td>
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<tr>
<td>Variable Costs – Site Prep</td>
<td>$72.11</td>
<td>$2,582.64</td>
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<tr>
<td>Variable Costs – Planting</td>
<td>$60.37</td>
<td>$2,241.12</td>
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<tr>
<td>Variable Costs – Establishment</td>
<td>$72.33</td>
<td>$2,205.53</td>
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</tbody>
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## Example Operating Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount per Acre</th>
<th>Total Cost</th>
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</thead>
<tbody>
<tr>
<td><strong>Ongoing Costs:</strong></td>
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<tr>
<td>Variable Costs – Harvest</td>
<td>$41.23</td>
<td>$1,649.05</td>
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<tr>
<td>Variable Costs – Storage</td>
<td>$3.36</td>
<td>$134.45</td>
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<tr>
<td>Variable Costs - Pelletting</td>
<td>$194.95</td>
<td>$7,798.00</td>
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<tr>
<td><strong>Total:</strong></td>
<td>$239.54</td>
<td>$9,581.50</td>
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</tbody>
</table>

That’s $ 88.72 per ton of pellets (not including labor)
Fuel and Lube (tractors, mills) 73%
Equipment Upkeep 16%
Land Cost 11%
Labor 0%
Buildings, Packaging 0%
Operating Costs
Labor Requirements

Harvest 4%
Storage 1%
Pelleting 95%

That’s 12.5 hours per ton of pellets
Pelleting Demo
Farm Energy IQ

Farms Today Securing Our Energy Future

Questions?

NORTHEAST SARE Sustainable Agriculture Research & Education