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

Pellet Theory - Densification
- Downward pressure
- Transverse and longitudinal compression – “dynamic plug”
- Cooling/hardening

What is in Biomass?

- Hemicellulose (~23% by mass)
- Lignin (~27% by mass)
- Cellulose (~45% by mass)

Extractives (~5% 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**

---

**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

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>Fixed Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>$1,103.13</td>
<td>$44,125.00</td>
</tr>
<tr>
<td><strong>Variable Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Prep</td>
<td>$72.11</td>
<td>$2,582.64</td>
</tr>
<tr>
<td>Planting</td>
<td>$60.37</td>
<td>$2,241.12</td>
</tr>
<tr>
<td>Establishment</td>
<td>$72.33</td>
<td>$2,205.53</td>
</tr>
</tbody>
</table>

### Example Operating Costs

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

That's $88.72 per ton of pellets (not including labor)

### Operating Costs

- **Equipment:** 16%
- **Land Cost:** 11%
- **Building, Packaging:** 0%
- **Fuel and Lube (tractors, mikes):** 73%
- **Labor:** 0%

### Labor Requirements

- **Harvest:** 4%
- **Storage:** 1%
- **Pelleting:** 95%

That's 12.5 hours per ton of pellets

---

**Farm Energy IQ**

**Pelleting Demo**

**Farm Energy IQ**

Farms Today Securing Our Energy Future

Questions?