Round Wood to Chips to Pellets

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Outline

- **Process**
- **Fixed or Stationary Chipping**
- **In Woods Processing**
- **Hauling**
- **Chip or particle sizes**
- **Grinding vs. Chipping**
- **Wood species**
- **Economics**

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Process

Requires:

- Chipping or grinding on site
- In-Woods chipping or grinding
- Debarking
- Hauling whole Log
- Hauling ground or chipped product
- Loading chips into your existing system
- Grinding or hammering raw chips to match your other feed stock

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Fixed or Stationary Chipping / Grinding

- Different systems include several different kinds of fixed location chipper or grinders
- The systems are designed to produce several different kinds of chip or particles.
- Particle size is critical to drying and hammering limitations in your existing facility.
- CE uses stationary chipping on site for the following reasons
  - ✓Less dust (air permit)
  - ✓Lower operating cost vs. grinding
  - ✓We have full length logs to process
  - ✓Less down time vs. grinding

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In-Woods Grinding or Chipping

- There are a large selection of different in woods grinding and chipping systems
  - Horizontal bed Grinder
  - Tub Grinder
  - Micro Chip Chipping
  - Drum chipping
  - Etc
- In CE's experience the mobile systems require more maintenance and have more down time than the stationary systems
- The mobile systems can be of value to traditional logging operations (ability to process low value material). Ability to process material that is otherwise difficult to transport
- The In-Woods systems require a fuel of maintenance truck to act as support vehicle

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In-Woods Grinding or Chipping

- Some of the larger in woods systems have grapple attached
- Most systems require and excavator to load the grinder or chipper
- Grinding project have to be of a certain size to justify the mobilization and set up costs
- CE is currently experiencing a 60% operational effectiveness in our in woods system
- If you want a pain in the posterior implement an In-Woods grinding programs
- CE currently operates an In-Woods grinding and hauling system

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Hauling

Material Hauling can be handled by using several standard units including:

- Stand logging truck
- Live floor chip trailers
- Standard chip trailers if your facility has truck tipping capabilities
- There are also some new and innovative methods being created to haul forest residues
- The newer systems can be designed to swap between hauling full log and chip trailers

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Stinger-Steered Chip Trailer

Designed to negotiate tight turns

Live floor unloading

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Chipping vs. Grinding

Grinding pros:

•Dry wood in more easy ground than green wood
•Easer to adjust particle size (screen change)
•Few changed in knifes or teeth
•Ability to process more random lengths and widths

Chipping pros:

•Green wood is easer to chip than to grind

•Chipping can provide more uniform chip (Less under and over size particles

•Can require less HP when knifes are kept sharp

•Less dust

•Quieter

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Wood Species

- Species with more bark will not lend itself to in woods processing because of ash content in the bark
- Hard wood that is dryer is going to be more difficult to chip and may require grinding
- Different kinds of feed stock will allow for different kinds of processing
- There is no one size fits all when you consider a whole tree application

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Chip or Particle Size

- Chip or particle size can be critical for several reasons:
- Chips from the stationary chipper can provide a more consistent chip (5% over's and under's)
- Grinding tends to provide less consistent size particles (20%+ over and under)
- Your existing drying capabilities may not be able to dry large size chips. You may have to hammer the chips into a smaller piece before entering the dryer
- Chip size may create issue with your existing hammer mill operations

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Economics

In Woods Grinding:

- CE runs the our In-Woods Grinding program as a separate business unit
- CE track all cost as feed stock costs
- We are currently working on
  1. Consistent production
  2. Controlling our costs
  3. Increasing efficiencies

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Grinding Matrix

Costs **Number of Tons Produced per Month**

	1500	2000	2500	3000	3500	4000
Material	$ 18,000	$ 24,000	$30,000	$ 36,000	$42,000	$48,000
Labor	$ 32,000	$ 32,000	$32,000	$ 32,000	$32,000	$32,000
O&M	$ 5,000	$ 6,250	$ 7,500	$ 8,750	$10,000	$11,250
Insurance	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Direct Cost	$ 1,000	$ 1,100	$ 1,200	$ 1,300	$ 1,400	$ 1,500
Cost per ton		**$ 38.67**	**$ 32.68**	**$ 29.08**	**$ 26.68**	**$ 24.97**

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Economics

Fixed Stationary Chipping:

- CE currently operates a fixed chipping operation
- CE relies exclusively on whole log processing
- We are currently working on
  1. Controlling our costs
  2. Increasing production
  3. Increasing efficiencies

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Chipping Matrix

Costs **Number of Tons Produced per Month**

	1500	2000	2500	3000	3500	4000
Material	$45,000	$60,000	$75,000	$90,000	$105,000	$120,000
Labor	$16,000	$16,000	$16,000	$16,000	$ 16,000	$ 16,000
O&M	$ 3,000	$ 3,750	$ 4,500	$ 5,250	$ 6,000	$ 6,750
Insurance	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
Admin	$ 1,000	$ 1,100	$ 1,200	$ 1,300	$ 1,400	$ 1,500
Cost per ton	**$ 43.67**	**$ 40.68**	**$ 38.88**	**$ 37.68**	**$ 36.83**	**$ 36.19**

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