

INL Feedstock Workshop – August 2011

Size Reduction with Selective Material Orientation



forestconcepts™

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This presentation is based upon research and development that was supported in-part by the U.S. Department of Energy Office of Biomass Programs Small Business Innovation Research Program Contract No. DE-SC-0002291.

Agenda

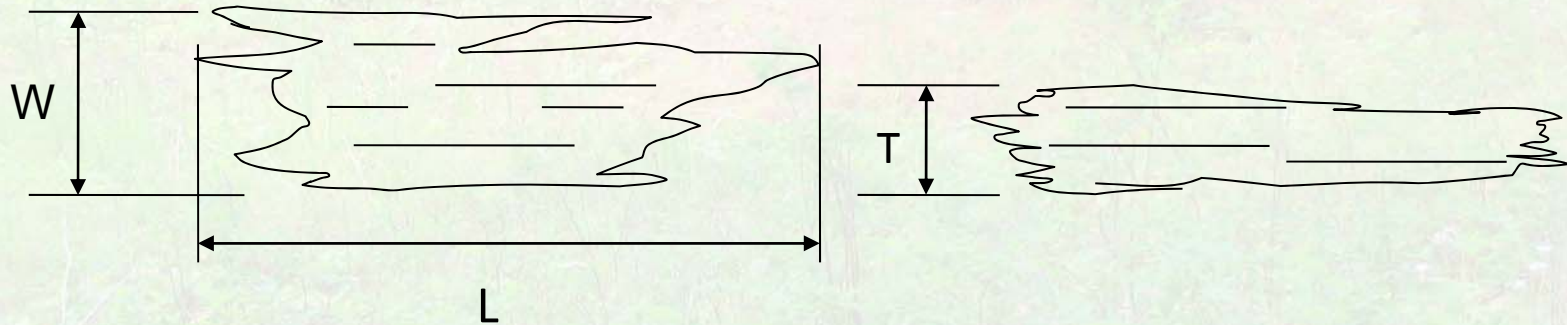
- Design Objectives and Constraints
- Taking Advantage of Natural Modes of Failure
- The Forest Concepts Comminution process
- Final Thoughts

Objectives and Constraints

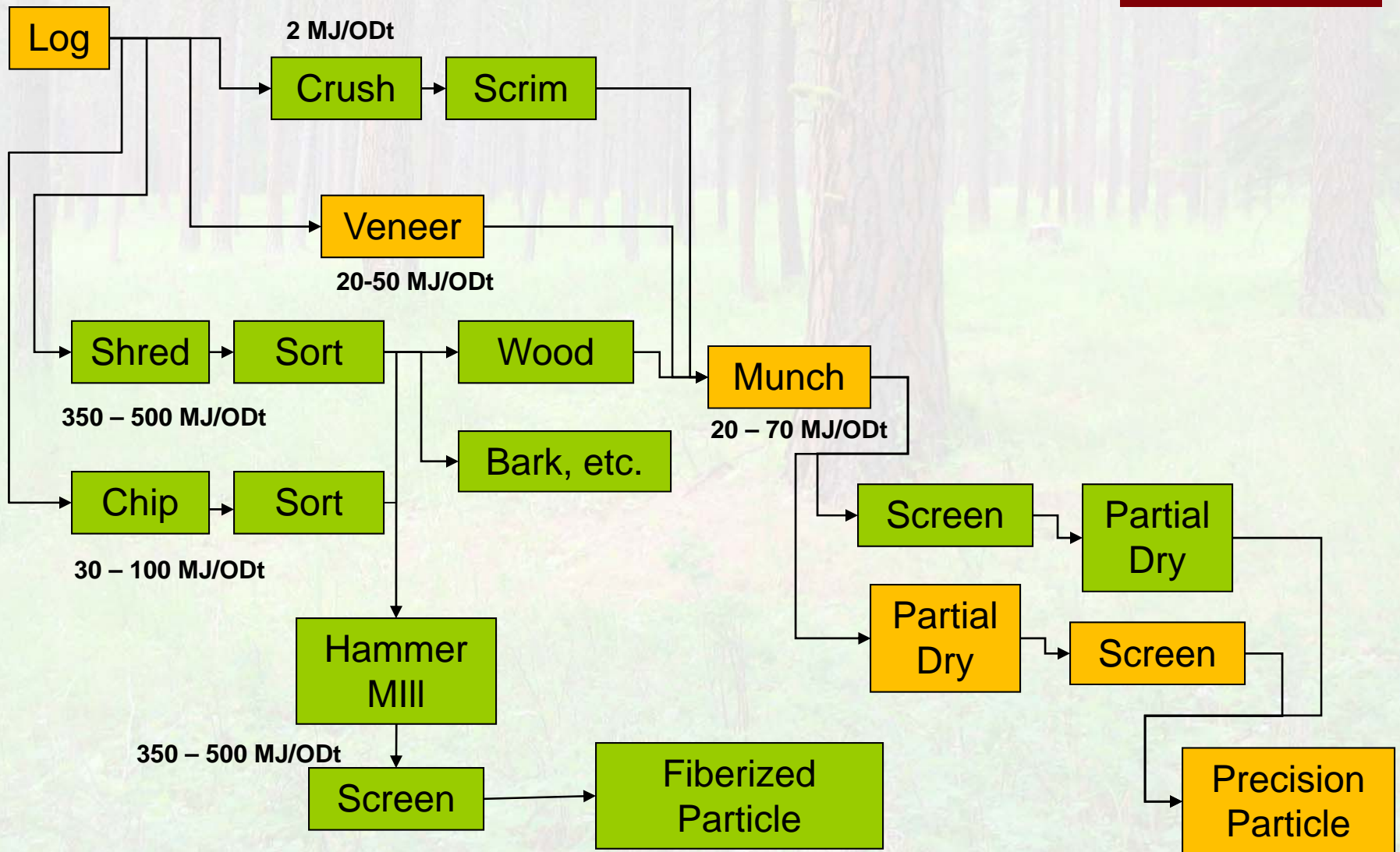
- Maximize transport and storage density
 - Convert logs to industrial veneer
- Ensure flowability similar to grains
 - Produce uniform sheared cubic particles
- Minimize comminution energy
 - Cutting parallel to grain minimizes energy
 - Single-pass shearing minimizes frictional heat
- Produce particles optimized for conversion

Natural Modes of Failure

- Fibrous biological materials can fail in seven unique ways
 - Compression, brittle, shear,...
- Plants are very weak perpendicular to grain



Pathways to Precision Particles



Why Industrial Veneer ?

- High transport density
- Controls thickness dimension
- Enables separation of heartwood, sapwood and bark
- Enables orientation with grain for next processing operation



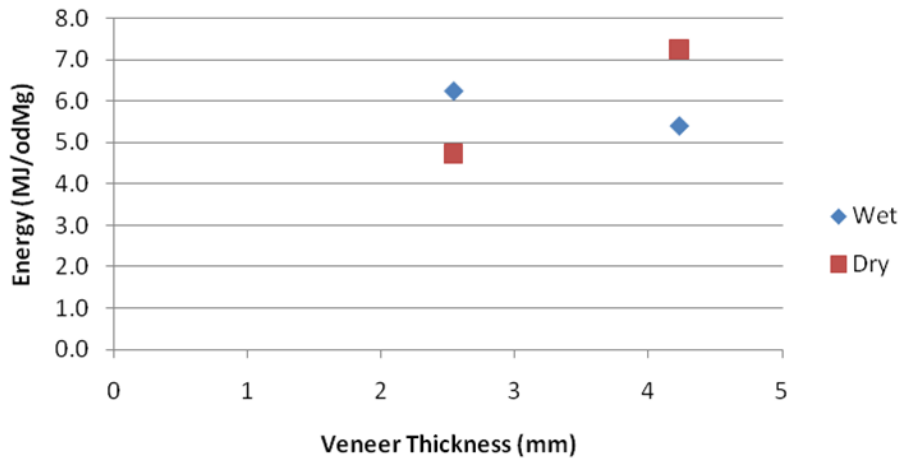
Veneer Making Video



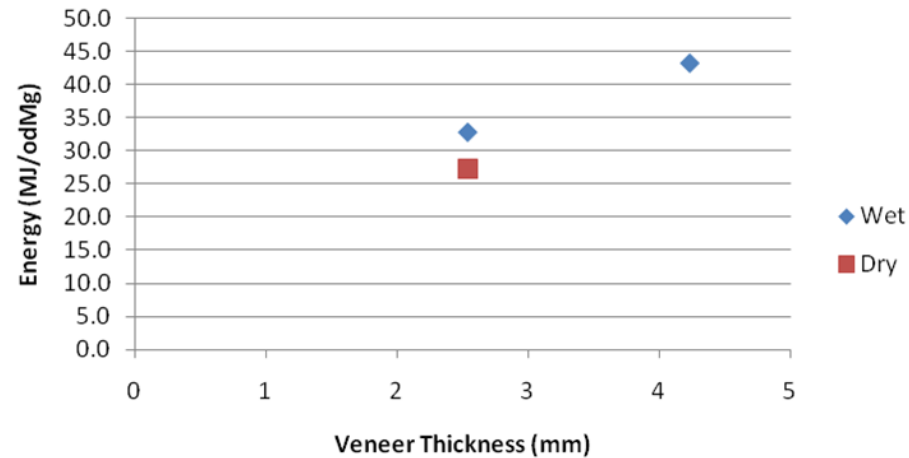
Rotary Shear WoodMuncher™

- Low energy comminution method
- Orient parallel to grain or cross-grain

Parallel to Grain MJ/odMg



Cross-Grain MJ/odMg



Does Length Matter?



Longer particles take less energy to make

WoodMuncher™ Video



Final Thoughts

- Work with natural modes of failure
- Veneer offers high density transport
- Single pass shearing minimizes energy
- Resulting particles have high surface area, high uniformity, high yield
- Crumbles™ particles are flowable
- Same design principles probably work in herbaceous crops

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Thank You



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