Pre-Processing Biomass

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Cellulosic Supply Chains Short Course
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Healthy Ecosystems, Healthy Economies, Healthy Energy
What is “pre processing”? 

Pre-processing as Part of the Supply Chain

- LOW QUALITY FOREST
- HIGHER QUALITY FOREST
- HIGHER QUALITY FOREST
- BIOMASS
- USABLE FUEL
- ENERGY
Pre-processing as Part of the Supply Chain

LOW QUALITY FOREST

LOW QUALITY FOREST

HIGHER QUALITY FOREST

HIGHER QUALITY FOREST

BIOMASS

BIOMASS HARVEST

FOREST MANAGEMENT

TRANSPORT

PROCESSING

USABLE FUEL

ENERGY

The key question:

- Can pre-processing make the overall system work better / be more cost effective?
Potential Benefits of Pre-Processing

• Easier to handle
• Easier to store
• Easier to transport
• Easier to transform into energy

Increased value to biomass, improved effectiveness of supply chain

Pre-processing Options

• Size Reduction
  – Chipping and Grinding
• Densification
  – Bundling, Baling, Pelletizing, Briquetting
• Drying
• Thermochemical Conversion
  – Torrefaction, fast pyrolysis, slow pyrolysis, gasification, hydrothermal treatment
• Biochemical Conversion
  – Digestion
• Fiber Expansion
Size Reduction

IN-FOREST CHIPPING $22 per green tonne
AT-PLANT CHIPPING $8 per green tonne
WOOD GRINDING $17-22 per green tonne
BALE GRINDING $6-10 per green tonne
Bundling and Baling

BUNDLING FOREST WOOD RESIDUES
collect, bundle, forward
$13-17 per green tonne

BALING FIELD CROPS – small bales
mow, rake, bale
$10-42 per green tonne

BALING FIELD CROPS – large bales
mow, rake, bale
$13-26 per green tonne

BALING WOOD RESIDUES
bale, forward
$23 per green tonne

BALING SRWC
bale, forward
$16 per green tonne
Drying

ROTARY DRUM DRYING OF WOOD CHIPS

$1.5 – 3 per green tonne
3-9 MJ per kg H₂O


http://bedford.extension.psu.edu/agriculture/BeginFarmer/Crop%20Production.htm

Torrefaction

Torrefaction

GRINDING $17 – 22 per green tonne
DRYING $1.5 – 3 per green tonne
ROASTING $19 per green tonne
TOTAL $37.5 – 44 per green tonne

Pelletizing
Pelletizing

GRINDING $17 – 22 per green tonne
DRYING $1.5 – 3 per green tonne
PELLETIZING $20 per green tonne
TOTAL $38.5 – 45 per green tonne

Does Pre-Processing Reduce Overall Costs?

Euros per GJ

Tor, 32 Tor Pel, 32 Pel, 71 TOP, 71 Tor Pel, 267 Tor Pel,

Shipping
Trucking
Storage
PreTreatment
Sizing
Biomass
Should we Pre-Process?

- Pre-processing biomass is costly and rather uncertain
- However, pre-processing could improve the overall efficiency and effectiveness of the supply chain
- The efficacy of biomass pre-processing in the northeast region needs careful assessment

- Productivity and costs of slash bundling in Nordic conditions. K. Kärhät, a, and T. Vartiamäki