

Pretreatment of Biomass to Facilitate Its Use in Industrial Processes

by Donald Fosnacht

April 9, 2014

dfosnach@nrri.umn.edu

Phone: 218-720-4282

**Natural Resources
Research Institute**

UNIVERSITY OF MINNESOTA DULUTH
Driven to Discover

Pretreatment facilitates Wood Utilization

- Wood is very different in both grinding properties and in fuel value compared to traditional solid fuels
- It is very advantageous in having low Ash, Sulfur, and Mercury
- Pretreatment with torrefaction concentrates the energy value, increases grindability and makes it similar to semi-bituminous coal
- Pretreatment also makes the material easier to gasify for subsequent conversion of the gas to liquid fuels (e.g., high quality diesel)

Stages of our development for torrefaction

2007 – 09. Benchtop Studies:



Lab Electric Oven



Gas-Heated
Rotary Reactor



Chip Fired Tube
Reactor

10 wood species evaluated:

Quantified differences across species

Established densification parameters:

- HHV, Elemental Composition
- Feed grind specifications
- Density vs pressure profiles.

2010 – 12. Piloting:



6" Continuous Thermostatic Rotary
Reactor, 40 – 60 kg/hr

Production of torrefied wood for studies on coal replacement:

- 10%, 20%, and 30% replacement for mining industry
- Emission characteristics of replacing coal with torrefied biomass

2013 – current. Demo Plant:



Next Scale Under Assembly

Currently Being Installed to allow Demonstration Level Use at Actual Utilities and Other Industrial Facilities (Heyl & Patterson kiln, M-E-C dryer), later moving bed system from Syngas Technologies and Advanced Boiler-generator from Sustainable Rail



Select the desired material form.



Laboratory Schematic of HTC-Testing

Loaded (1:5 ratio)



**Processing
(15 min. @ 240°C)**



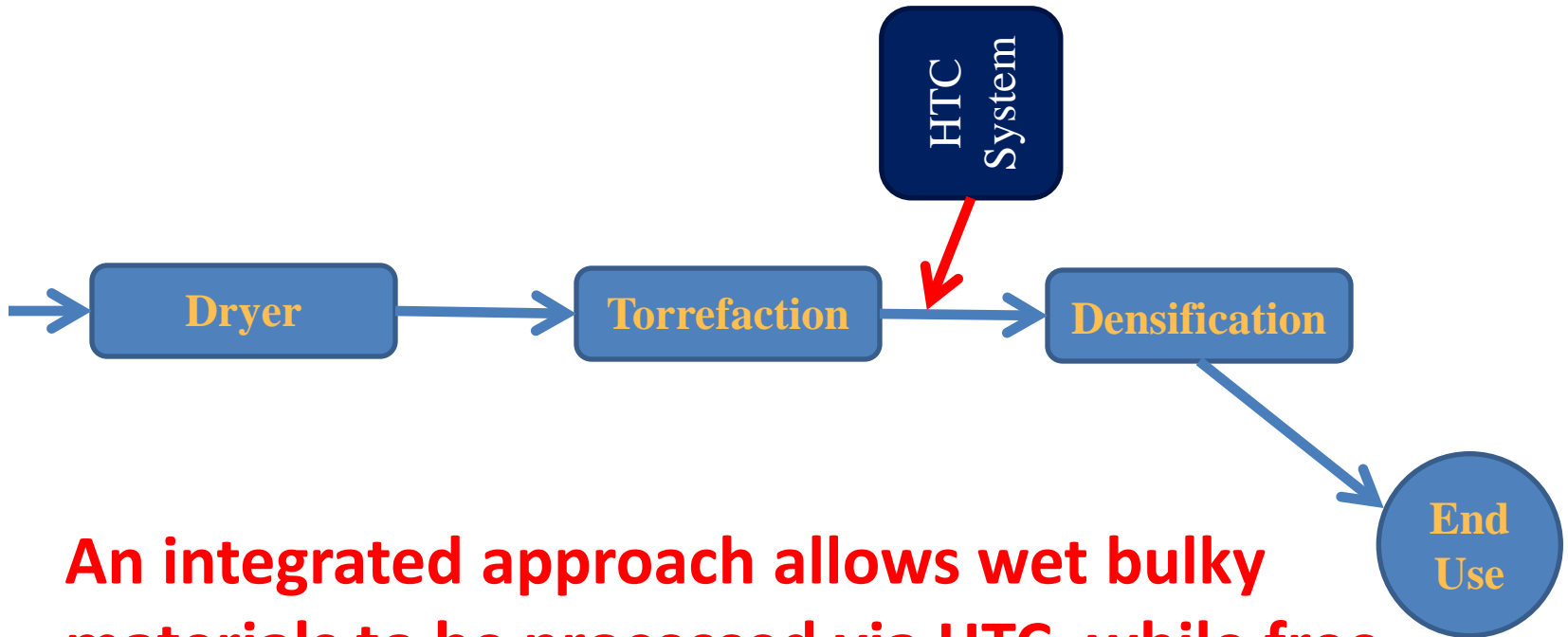
Processed



**Biocoal
and Liquor**



Flow through unit now in engineering



An integrated approach allows wet bulky materials to be processed via HTC, while free-flowing materials are processed via torrefaction.

Integrated Torrefaction and Briquetting Demo Plant

Location: NRRI – CMRL;
Set In Service: 3rd Qt. 2014(plan).

Capacity: 12 ton/day;
Feedstock: Wood Chips;

Operation: Continuous;
Process Energy: NG + Off-gas utilization.

