BIOTHERMIC
WOOD ENERGY SYSTEMS

SOLID WOOD BIOFUELS *(AKA WOOD)*

Vince Rutter

INTRO

- Vince Rutter: Forester, Arborist, Entrepreneur, Wood Heating Professional
- Biothermic: specializing in the sale and supply of biomass heating equipment.
  - Fröling Boilers
  - Polytechnik Combined Heat and Power Plants
  - Pezzolato Wood Chippers
  - Tropper Wood Pellet Trucks
  - Wood chip fuel sales

- *To be successful at any part of biomass heating, you must understand the entire process from Stump to Stack.*

WOOD FUEL

Overview:

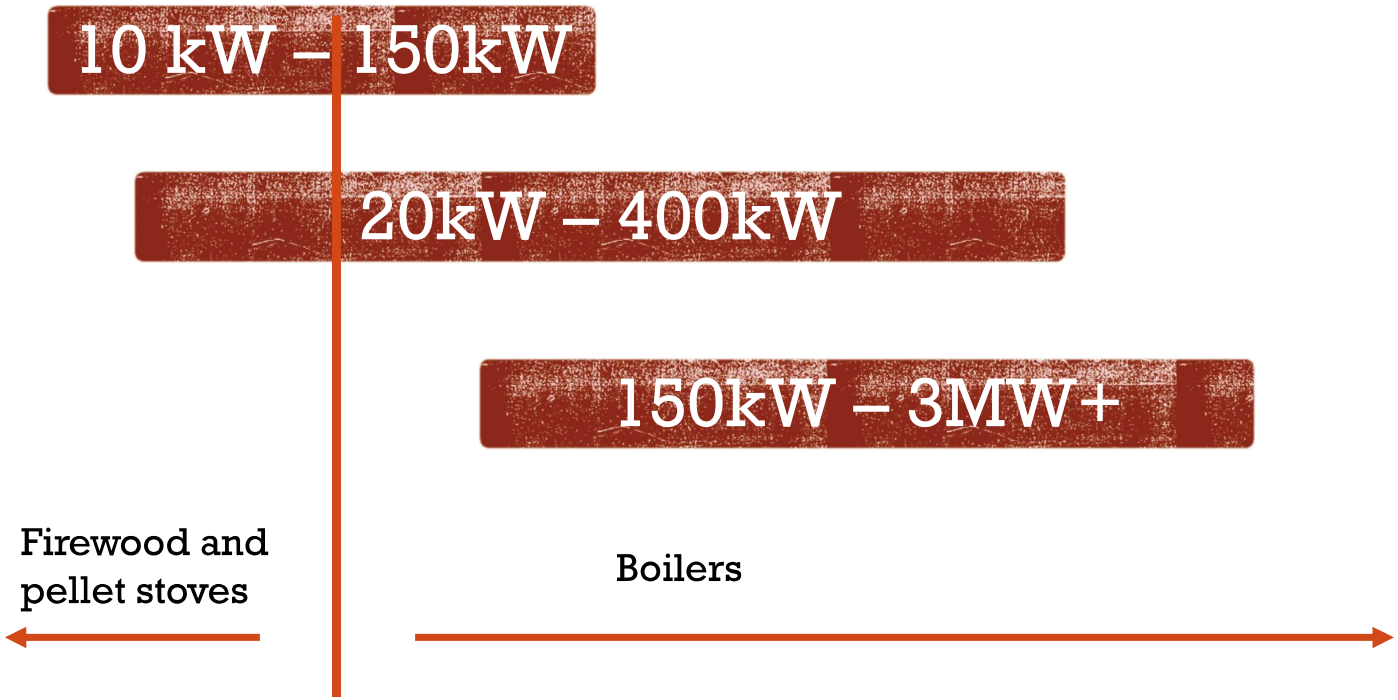
- Appropriate fuel for appropriate heat load
- Firewood basics
- Wood pellet basics
- Wood chips in more depth
- Wood chipper technology

- All in 20 minutes!

WHICH FUEL TO USE?

1 kW = 3,400 BTU

WHICH FUEL TO USE?



FIREWOOD

- The most ancient, well known and widely used energy source
- Wood burns in two stages:
  - Primary combustion (Gasification)
  - Secondary combustion (Gasses burning)
- Gasification occurs with controlled air flow and DRY WOOD!

- Freshly cut wood is 45% to 55% moisture. **Firewood should be between 20% and 30% for good combustion and low emissions.**

WOOD PELLETS - HIGHER COST, EASY TO USE

40 pound bags.

- Easily available
- $5-$8 per bag ($275-$440/T)
- Easily stored and handled

One tonne super sacs (totes)

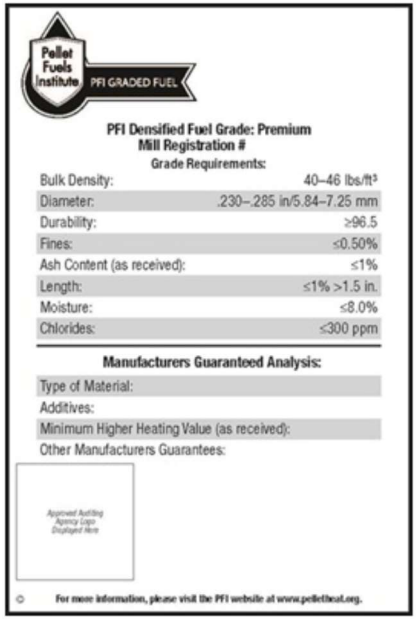
- Available at most mills
- $150 to $250 per tonne
- Heavy. Machinery required to move them (They weigh a tonne! Literally)

Bulk Delivery

- Easy, No Handling!
- Unavailable in many regions
- $250 to $400 per tonne delivered

PELLET QUALITY IS CRUCIAL!

- Ash Content
- Energy content
- Dust or fines content (visible)
- Moisture content
- Durability
- Diameter and Length
- Bulk Density


Pellet Fuels Institute
PFI GRADED FUEL

PFI Densified Fuel Grade: Premium
Mill Registration #
Grade Requirements:

Bulk Density:	40–46 lbs/ft³
Diameter:	.230–.285 in/5.84–7.25 mm
Durability:	≥96.5
Fines:	≤0.50%
Ash Content (as received):	≤1%
Length:	≤1% >1.5 in.
Moisture:	≤8.0%
Chlorides:	≤300 ppm

Manufacturers Guaranteed Analysis:

Type of Material:	
Additives:	
Minimum Higher Heating Value (as received):	
Other Manufacturers Guarantees:	

Approved Auditing Agency Logo Displayed Here

For more information, please visit the PFI website at www.pelletheat.org.

WOOD CHIPS

- Wood chips are not the same as wood chips and they're definitely different than wood chips! Ignore the details of wood chips at your peril!

Sawdust –high surface area. Good for making pellets

Shavings – usually very dry, ok for some boilers. Better for animal bedding

Chips – perfect!

Hog Fuel – beware!

Consider your feedstock! In this order:

- Moisture Content
- Particle Size
- Contaminants
  - Species
  - Price

MOISTURE CONTENT

- The 30% Moisture Content line

Below

- Good primary and secondary combustion in the boiler
- Reliability and stability
- Lighter fuel, lower transport costs
- Better movement through augers
- Fewer problems = Happy customers

Above

- Active decomposition, fugal spores, fermentation odour, steam
- Clumping of chips when ambient temp below freezing – problems with conveyance
- Fines within fuel will stick to surfaces causing jams
- Poor combustion, higher emissions
- Boiler maintenance problems
- Unhappy customers

Our process for drying green chips

- All chips are "green" with MC> 45%
- Decomposition occurs immediately and piles reach >40C within days.
- Moisture is driven out of the pile and decomposition stops when MC gets below 30%
- Chips are screened and stored under a stretch fabric dome to continue drying, reaching MC of below 30%

- Small energy content loss from decomposition
- Impossible to handle and deliver chips above 30%MC

BETTER DRYING….

- Logs left in piles where sun and airflow are plentiful will reach lower MC over one season.
- No building required for storage
- Chip logs and deliver directly to boiler customer

- Problem: cashflow in holding log inventory
- Problem: Must match handling and chipping equipment to flow of product

PARTICLE SIZE

>80% has to be in here!

Shavings and Sawdust

Graded heating fuel

Hog Fuel

Dimensions (mm), ISO 17827-1				
Main fraction [a] (minimum 60 w-%), mm	Fines fraction, w-% (≤3,15 mm)	Coarse fraction, w-%, (length of particle, mm)	Max. length of particles [b], mm	Max. cross sectional area of the coarse fraction [c], cm^2
P16S 3,15 mm < *P* ≤ 16 mm	≤ 15 %	≤ 6 % (>31,5 mm)	≤ 45 mm	≤ 2 cm^2
P31S 3,15 mm < *P* ≤ 31,5 mm	≤ 10 %	≤ 6 % (>45 mm)	≤ 150 mm	≤ 4 cm^2
P45S 3,15 mm < *P* ≤ 45 mm	≤ 10 %	≤ 10 % (>63 mm)	≤ 200 mm	≤ 6 cm^2

Fines stick to surfaces, bind chips together, hold moisture

Oversize particles cause bridging and jams


>63mm!

Our process for controlling particles

- Chips fed into screening plant
- Production rate of 30 m3 per hour
- Three decks remove fines and overs (mostly!)

- Imperfect and costly
- Required to accept urban forest wood chips to process into fuel
- At $0/tonne feedstock cost, price is competitive

CHIPPERS!

North American chippers are made for production, not wood chip quality

Why?

- No demand for quality chips

Drum with knives

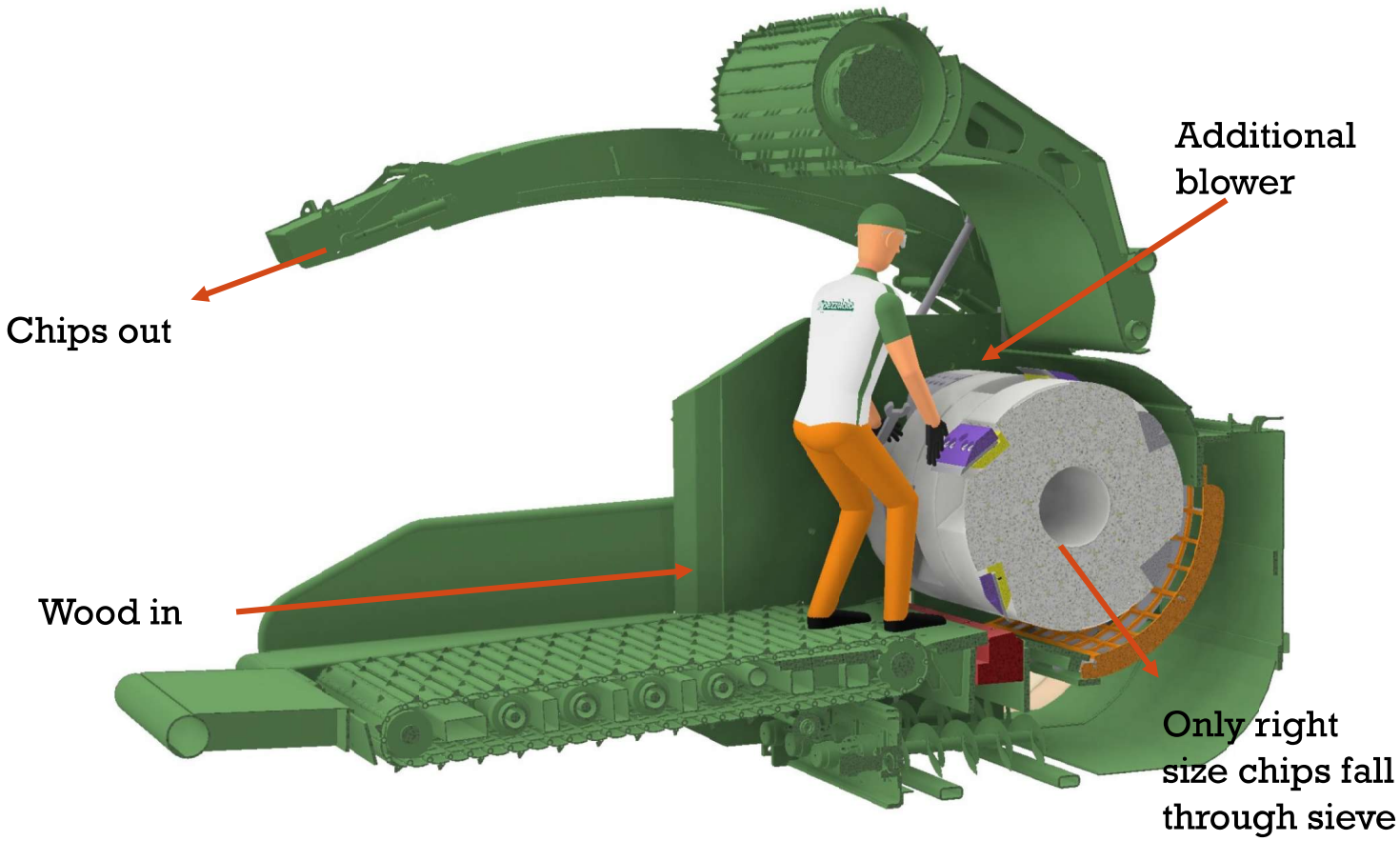
Chips out

Wood in

Engine

EUROPEAN CHIPPERS

- Chips go directly into the storage bunker, ready for the boiler
- No need for screening
- Chipper does not control Moisture Content


Additional blower
Chips out
Wood in
Only right size chips fall through sieve

CLEANLINESS IS NEXT TO GODLINESS

- Anything that is in the chips will either get stuck in part of the feed system or will make it into the combustion chamber
- Rocks, nails, pop cans, glass, diamonds will not burn and can cause damage to the boiler!

- One small amount of gravel can cause a boiler fault and an unhappy customer!
- One rock can jam an ash auger and cause a full day shutdown

QUESTIONS...

Mike Rutter
Biothermic Wood Energy Systems Inc.
www.biothermic.ca
vince@biothermic.ca
807-355-5519

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