



# Production of Biochar



The Promise of Biochar  
Harvesting Clean Energy  
Kennewick, WA  
February 7, 2010



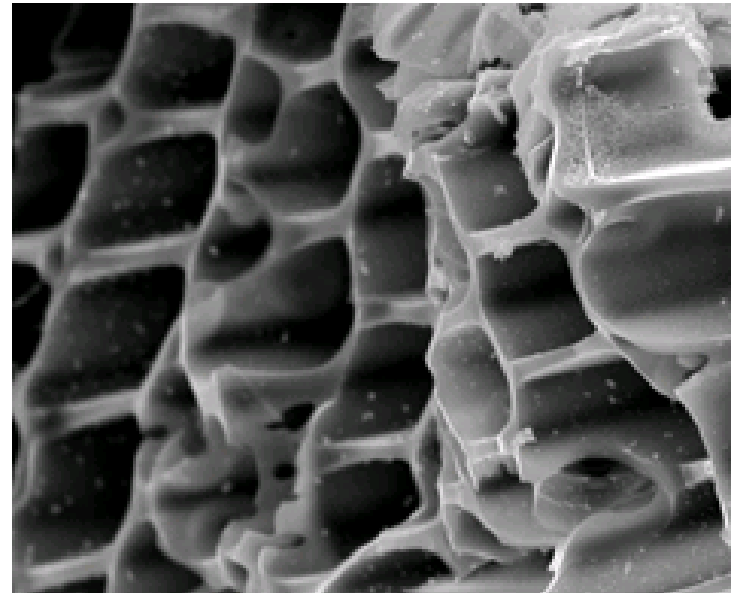
T R Miles Technical Consultants

# What is Biochar?

**Biochar is a fine-grained, highly porous charcoal that helps soils retain nutrients and water. IBI**



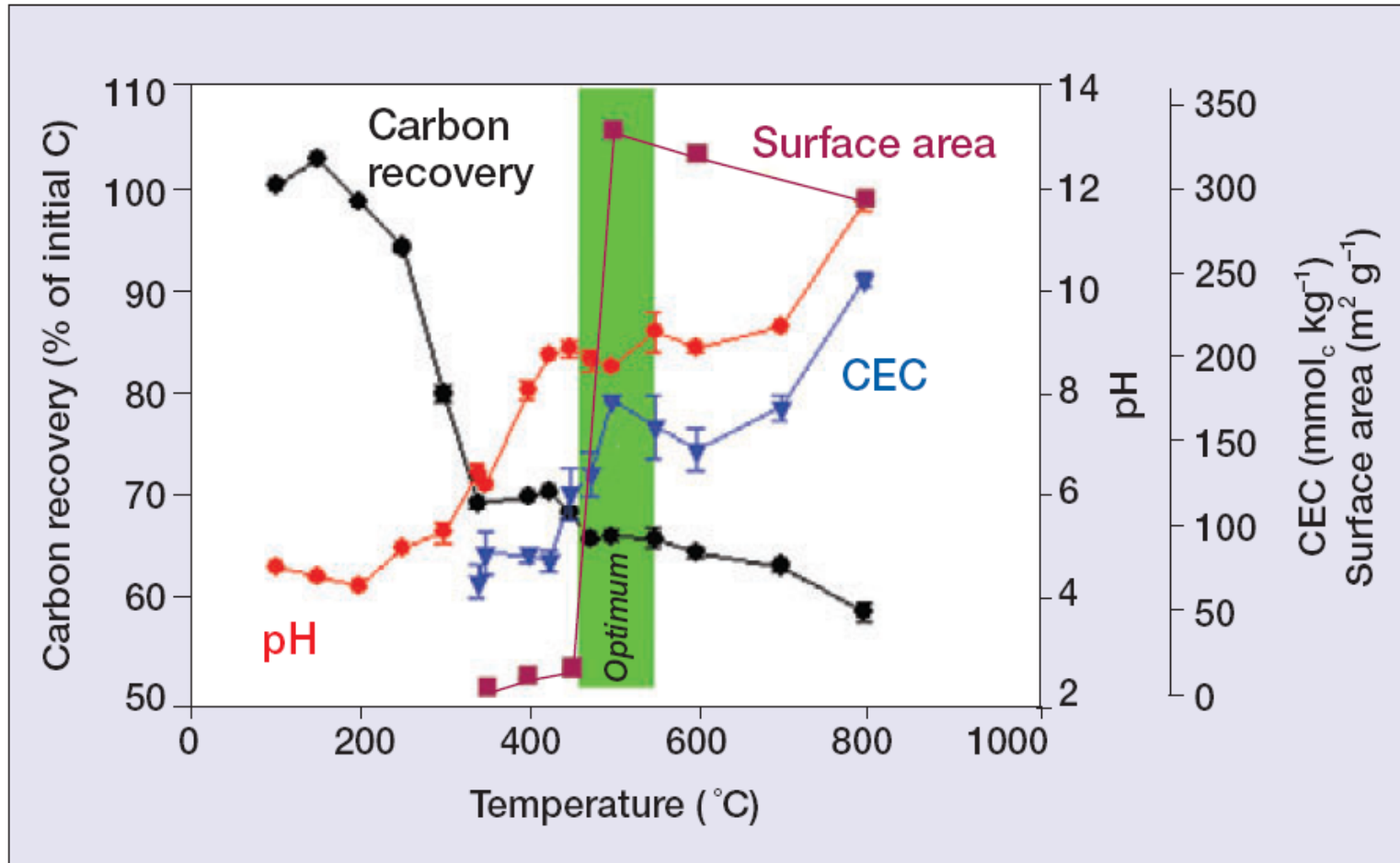
**ICM**



**COLLINS**

# What is Biochar?

Biochar can have different qualities depending on feedstock and process conditions.



# Product Value: What is Biochar Worth?

## Agronomic Benefits

### SOIL STRUCTURE-

Vermiculite substitution

### PLANT HEALTH -

Inhibit root disease

### NUTRIENT FILTER -

Remediation



2008



2009

**Ponderosa Pine in Soilless Media with Vermiculite (Left) and Biochar (Right)**

# Northwest Biomass Sources and Biochar Markets

- Sources
  - Forest residues – slash, fuel reduction, restoration
  - Crop residues – grain and grass seed straw
  - Agricultural and Forest Industry process residues
  - Urban wood waste
- Markets
  - Horticulture, nursery and urban landscaping
  - Turf establishment and maintenance
  - Soil remediation and storm water nutrient management
  - Crops and soil amendment, e.g. biochar + digested solids, composting



**Inspecting Seedlings Grown in Media with Biochar**

# Sources and Products



**Urban and Forest Wood**



**ICM GASIFIER**



**Wood Char**



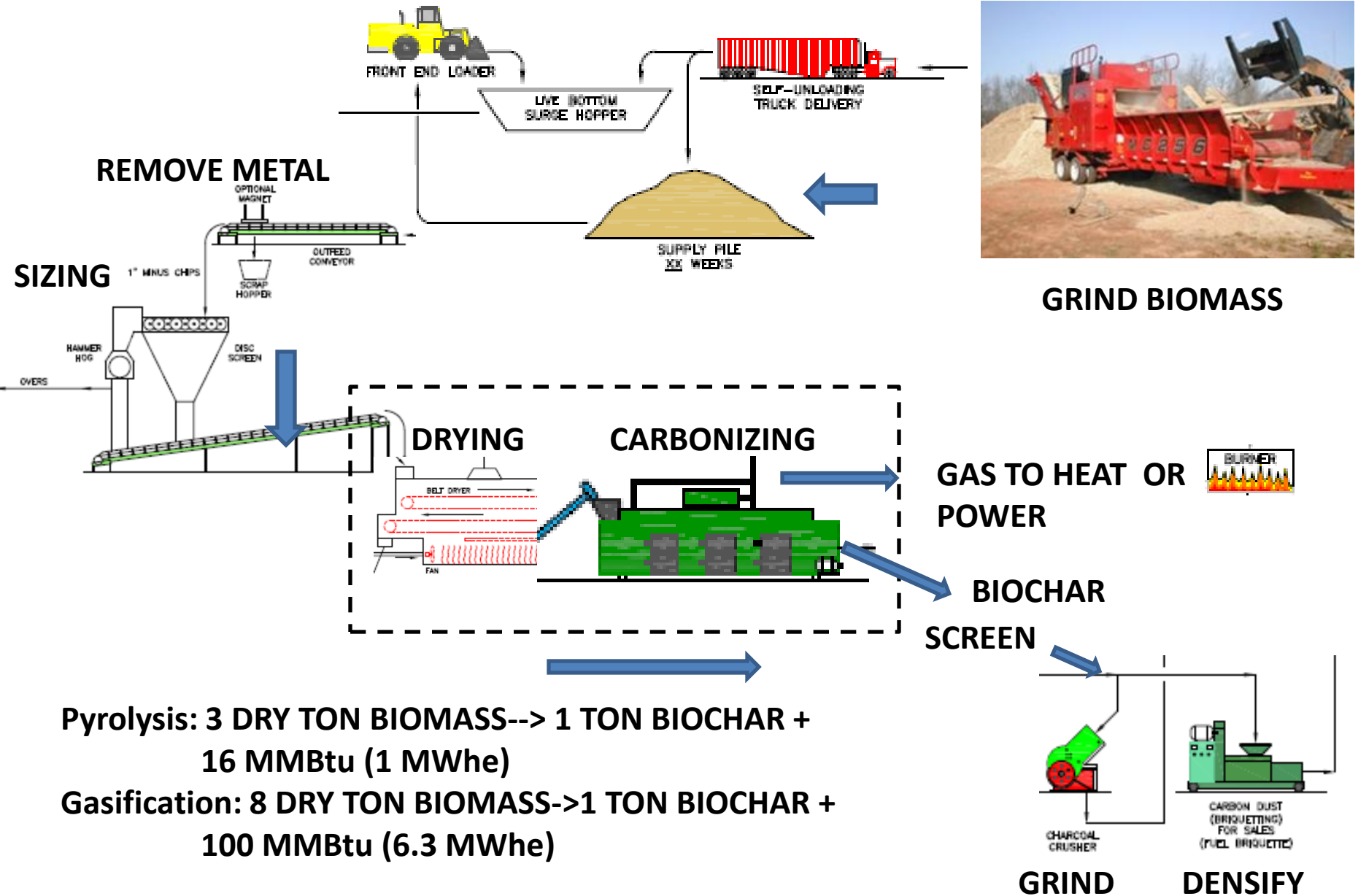
**Wheat Straw or Corn Stover**



**Straw Char**

[www.icminc.com/services/gasifiers](http://www.icminc.com/services/gasifiers)

# How biochar is made

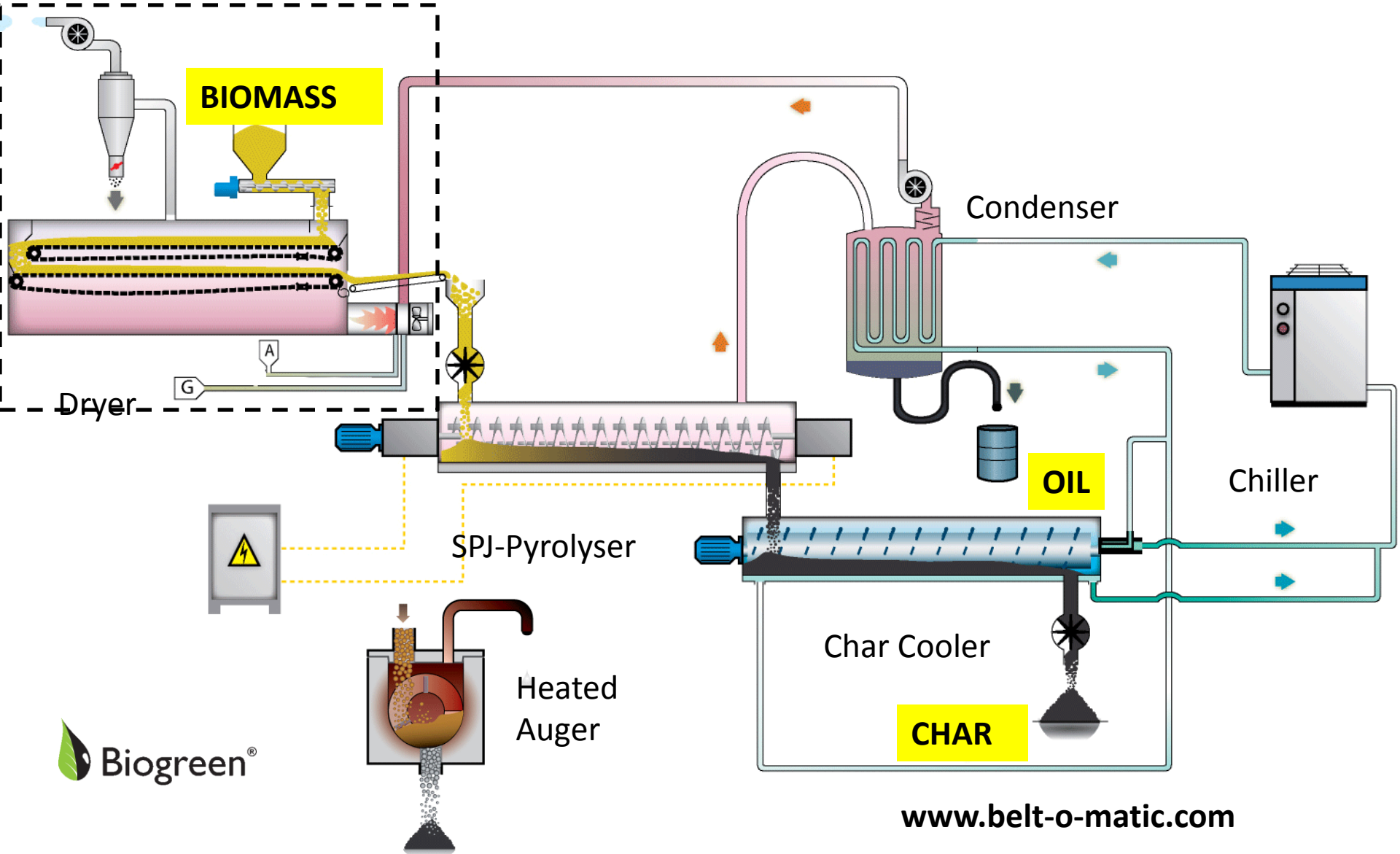


**GRIND BIOMASS**

**Pyrolysis: 3 DRY TON BIOMASS--> 1 TON BIOCHAR + 16 MMBtu (1 MWhe)**

**Gasification: 8 DRY TON BIOMASS->1 TON BIOCHAR + 100 MMBtu (6.3 MWhe)**

# Making Biochar and Oil: Spirajoule Pyrolysis





# Pyrolysis: JF Biocarbon Systems



**Mobil Demo System**



**During Emissions Tests**

**Heated Augers**

***JF Biocarbon Systems  
jovick@telus.net***

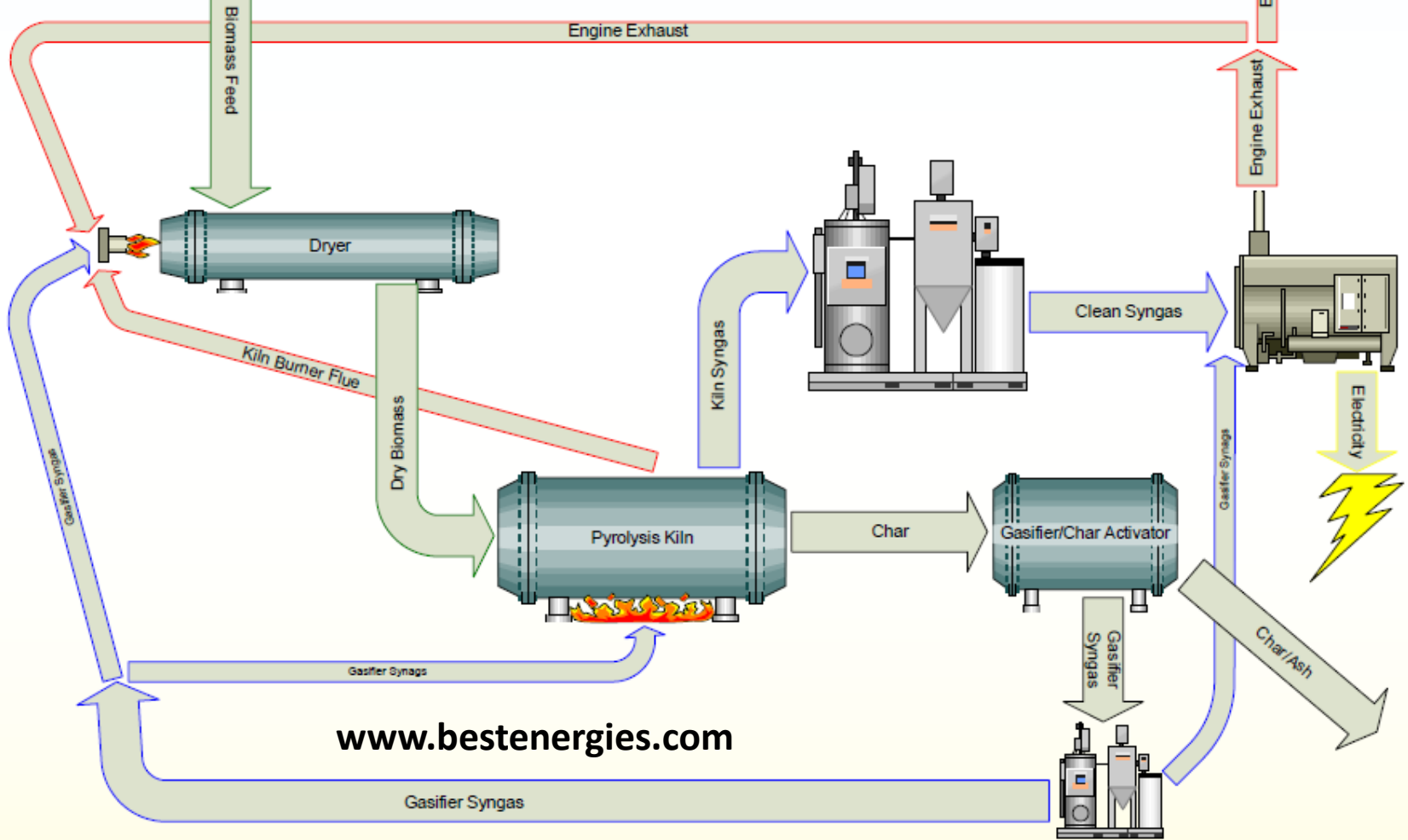


# Pyrolysis: BEST Energies

Simplified Process Flow Diagram (PFD)



2 TPH





# Alterna Biocarbon Continuous Kiln

[alternabiocarbon.com](http://alternabiocarbon.com)

# Making Biochar for Under \$10,000,000



**ICM**



**Greenhouse, boiler, biochar  
Stirling Engine (DK)**



**HNEI Flash  
Carbonization**



**Bioenergy LLC (RUS)  
Yuri Yudkevitch**



**Alterna Biocarbon (CAN)  
Continuous Kiln**

# Making Biochar for Less Than \$1,000,000

## COMMERCIAL AND BYPRODUCT BIOCHAR PRODUCTION

### CHAR MAKERS



**CHaP (UK)**  
**60 KWe + 32 kg Char**

### BOILERS



**3 MMBtuh Hot Water**  
**25% Char+Ash**

### GASIFIERS



**Seed Screenings**



**Mobile Pyrolysis**  
**Black is Green (BIG) AUS**



**0.5 MMBtuh Hot Water**  
**25%-30% Char+Ash**

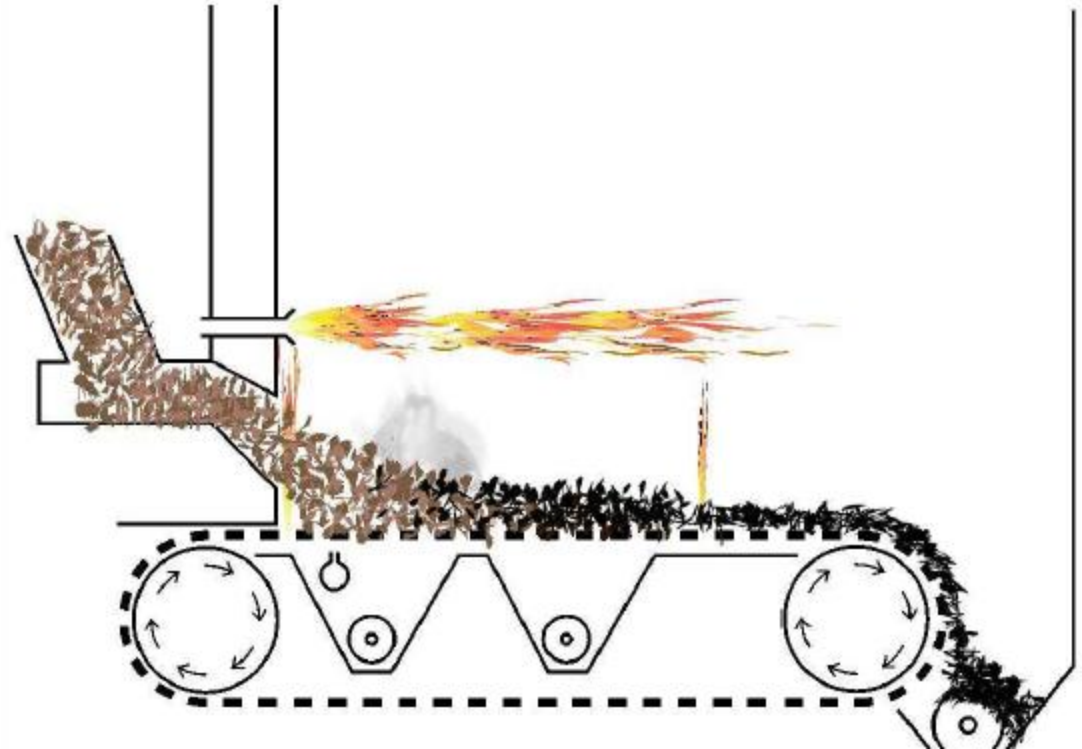
**100 kWe 10% Char**  
**Northern Excellence MN**  
**U N Dakota EERC**

# Staged Combustion in a Greenhouse Boiler

Boiler  
Chain Grate Stoker



Two Stage Combustion  
with Char



Burt's Greenhouses  
Ontario, CAN  
Alex English  
NE Biochar Symposium 2009



# Biochar Engineering B-1000 Gasifier



[www.biocharengineering.com](http://www.biocharengineering.com)

# Making Biochar for Under \$30,000



**ADAM RETORT (Pakistan) 1 T Batch**  
[www.biocoal.org](http://www.biocoal.org)



**New England Biochar Reactor 1 T Batch**  
Heat recovery for 5,000 ft<sup>2</sup> greenhouse  
[newenglandbiochar.org](http://newenglandbiochar.org)



# Making Biochar for Under \$1000



**SIMPLE CHAR KILN**  
Folke Gunther

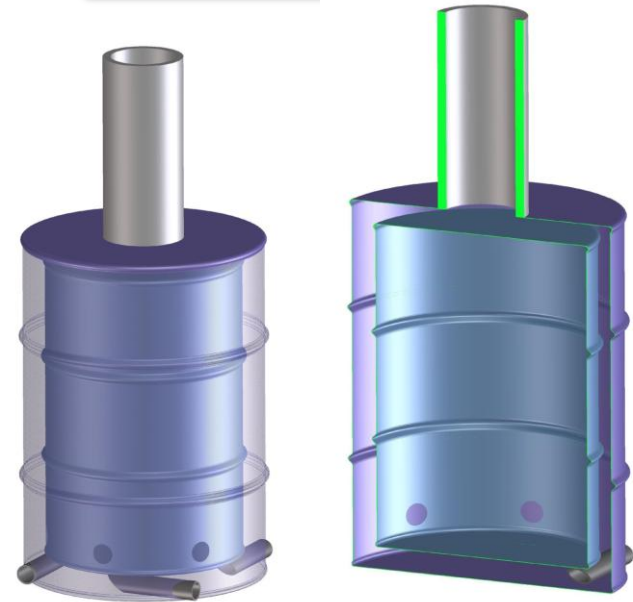
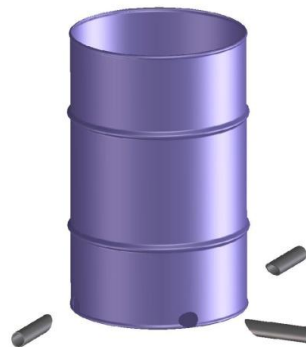
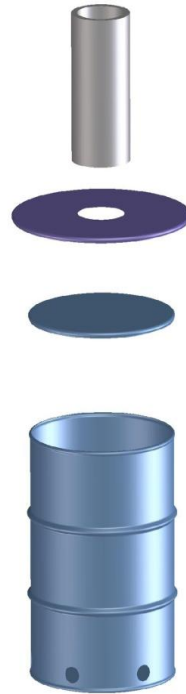
**Max Henderson**  
**Kelpie Wilson**

# Small Batch Barrel Kilns



**“SHOT GUN” BARREL KILN**

New England Biochar  
[newenglandbiochar.org](http://newenglandbiochar.org)



**“TIN MAN” BARREL KILN**

# Char From Top Lit Updraft Gasifiers

- Batch load.
- Gases burn above fuel.
- Heat from flame and partial burning drives volatile gases from fuel.
- Char remains after volatiles burn



**Pellet Gasifier**  
**Christa Roth**



**BioChar Cook Stove**  
**Seachar.org**



**ARTI India Char Barrel**

# Summary

- Large and small scale pyrolysis and gasification technologies for making biochar are available and under development.
- Biochar can be an important byproduct of gasification or combustion.
- Large production facilities are planned but not yet in operation.



[www.biochar.bioenergylists.org](http://www.biochar.bioenergylists.org)

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**Design and development of energy and environmental processes**

### **Industries**

**Biomass energy**  
**Pollution control**  
**Materials handling**  
**Feed, Food and Fuels**



# Links

- Northeast Biochar Symposium 2009  
[http://www.nsm.umass.edu/biochar09/presentations/Mass Biochar 2.pdf](http://www.nsm.umass.edu/biochar09/presentations/Mass_Biochar_2.pdf)
- Pacific Northwest Biochar [www.pnwbiochar.org](http://www.pnwbiochar.org)
- International Biochar Initiative  
[biochar-international.org](http://biochar-international.org)
- Bioenergylists.org [biochar.bioenergylists.org](http://biochar.bioenergylists.org)