Product and Process Options for the Biochar Entrepreneur

Scale-up: A Biomass Plant Perspective

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Building the future from the ground up
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Sonoma State University, Rohnert Park, CA
Hosted by the Sonoma Biochar Initiative

Topics

- Background
- Products and Co-products for Industrial Production
- Plant Capacity
- Processes
- Balance of Plant, Services
- Recommendations

Background 2006-2012

- Personal Discovery of *Terra Preta*
- Creative Biochar Product Development
- Adventurous Marketing
- Evolutionary Production Processes
- Massive Blogging

Some Potential Biochar Products and Markets

- Formulated soil amendments for Retail, Turf Management, Horticulture, compost, premix
- Growing Media - horticultural charcoal
- Additive to enhance compost or processed manures
- Stormwater and landscape restoration – biochar chips, pellets, fines

Industrial Biochar Quality Assurance Must Meet Specific Market Needs e.g. Stormwater

Uses	Functions	Qualities	Tasks
Filtration	Filtration	Hydraulic Capacity	Best Management Practices
Bioretention	Adsorb nutrients N, P	pH	Product Validation
Hydroseeding	Metal capture, Cu, Zn, Pb	Porosity	Product Certification
Growing media	Biological remediation	Integrity	Product Demonstration
	Plant uptake		

Industrial Production Sets Higher Product Standards : "Soil Amendment Products Must be Uniform and Predictable" (Chad Kruger, WSU Extension)

- Product variability must be within range suitable for an application identifiable by consumer, e.g. USCC compost specifications, product classes for specific applications
- Biochar used in a crop or resource management must have predictable results.
- Early products establish norms

Industrial Production:
Select Bankable Products and Co-Products

Chips

Rice
Husk
Char

Nut/
Shell
Char

Pellets

Wood
Pellet
Char

Biochar
Compost

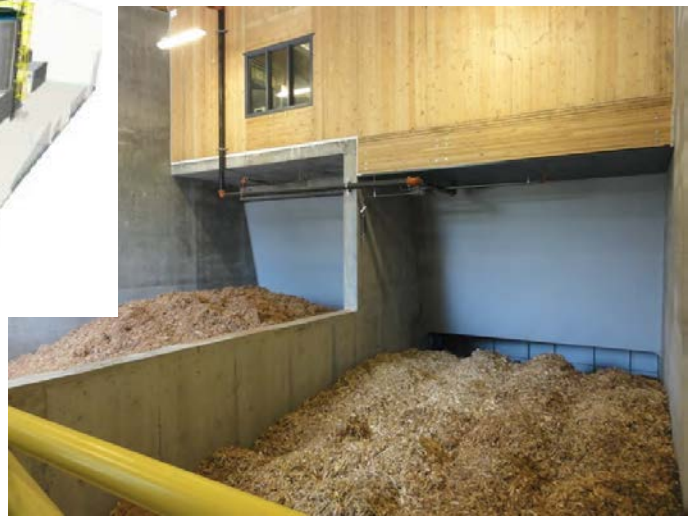
Bricks

Heat

Wood
Chip
Char

Common Fuel Processing: 20,000 tpy Dry Wood For Briquettes, Logs, Pellets or Biochar

Small Scale Combined Heat, Power and Biochar



Example:
UBC 2 MWe Gasifier
23,000 tpy grn

University of British Columbia, Vancouver, BC

www.nexterra.ca

Bioenergy Research and Demonstration CHP Project

UBC – 2 MW Biomass CHP Project

- Gross Power: 1.95 MW
- Net Thermal: 10 MMBtu/hr (80,000 MMBtu/yr)
- CO2 Red: 4,000 tpy (thermal only)
- Footprint: 180' X 90'
- Fuel Req: 12,500 BDMT/year (2/3 trucks/day)

Abrams, Nexterra, 2012

Biochar Plant Capacity

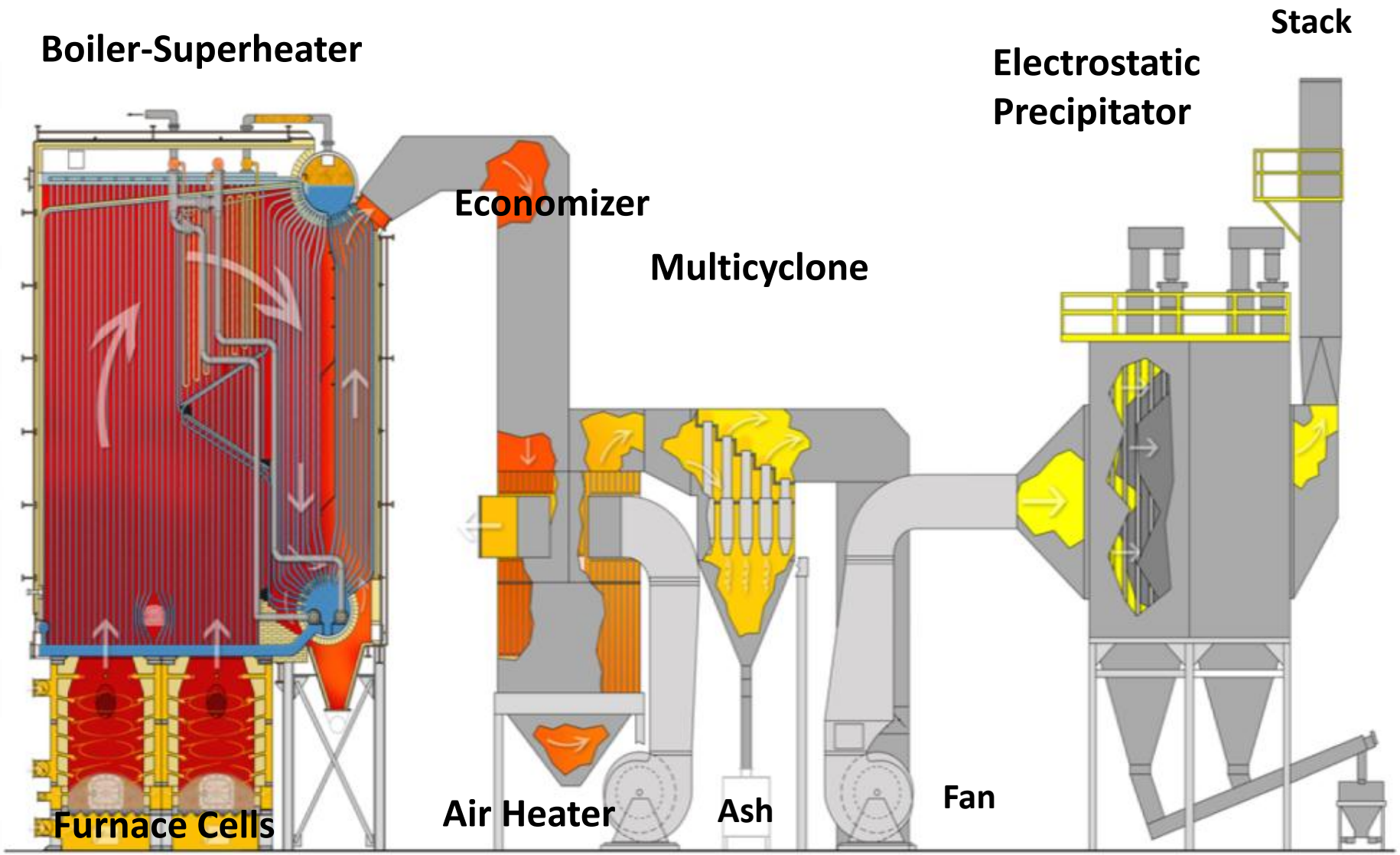
- Feedstock Processing: 3-12 tph, dry (equal to 3-10 MWe biomass plant)
- Biochar Production: 1-4 tph, 7,400-29,600 tpy
- Capacity Factor: 85% (100% capacity 7400 hours per year)
- Personnel: 2 per shift, minimum 8 payroll – to 23 for power or densified products
- Products: char, heat, oil products or power

Processes to Consider

- Receiving - Sources and variability
    - Captive biomass source – litter, manure, mill residue
    - Purchased biomass – green waste, urban wood, field crop residues
- Metal removal
- Sizing
  - Uniformity – chips, fines, pellets
- Drying
- Carbonization
  - Temperature control (HTT)
  - Retention and volatile content
- Oil, condensate and gas handling
- Char and Reactor Cooling
- Burners, Boilers
- Absorption chillers
- Co-processes: densification, composting
- Air quality – Annual tests, Continuous Emission Monitoring

Fuel Delivery, Receiving, Processing and Storage 6 MWe

A 6 MWe Gasifying Biomass Boiler With Heat Recovery and Emissions Control



Courtesy Wellons, Inc.

www.wellonsusa.com/energysolutions

A 6 MWe Biomass Plant Processing
50,000 dry tph biomass 358 days/year

Balance of Plant, Services

- Water treatment
- Plant power and grid connections, standby power
- Storm water plan
- Inert gas
- Cooling and refrigeration

Recommendations

- Select bankable products: biochar, compost, dried or densified products, heat, cooling.
- Electricity often has a high marginal cost. Gasification for power is not substantially commercial. Consider ORC.
- Industrial products must meet higher standards for performance and consistency.
- Capital costs will be equal to a biomass plant with similar production.
- Stationary plants have higher environmental and plant costs than mobile plants.
- Production must meet financial requirements with margin to properly maintain the plant.
- Visit a biomass plant with similar production capacity.

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**