Securing and Handling Biomass Feedstocks

Biochar 2010
Ames, IA
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T R Miles Technical Consultants

Biomass Sources and Biochar Markets

- Sources
  - Forest residues – slash, fuel reduction, restoration
  - Forest Industry residues – bark
  - Urban wood waste – recycling, compost
  - Agricultural process residues – poultry litter
  - Crops and residues – cob, straw, stover
- Markets
  - Horticulture, nursery and urban landscaping
  - Turf establishment and maintenance
  - Soil remediation, revegetation, storm water nutrient management
  - Crops and soil amendment, e.g. biochar + digested solids, compost

Bark – Log yard residue

Inspecting Seedlings Grown in Biochar Media

Scale of Biochar Production Affects Supply Choices

- Small scale direct use - farm, greenhouse
  - 3-20 tpy biomass ->1-6 tpy biochar
  - 1,000 tpy biomass -> 200 tpy biochar
- Production for purpose - soil amendment for consumers and remediation
  - 2,000 tpy biomass-> 600 tpy biochar
  - 50-100,000 tpy biomass-> 15-30,000 tpy biochar
- Co-product of energy processes – field agriculture.
  - biochar, energy, ethanol 300,000 tpy-> 3,000 tpy biochar
  - Pyrolysis with biochar 300,000 tpy-> 45,000 tpy biochar

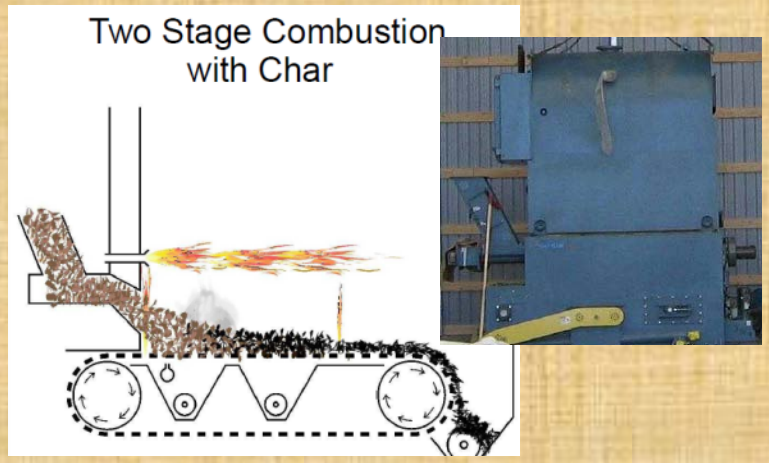
Small Scale Direct Use – Farm, Greenhouse

Simple Char Kiln
Folke Gunther

Barrel Kiln

Batch Reactor w/heat recovery
newenglandbiochar.org

Mobile Pyrolysis
Black is Green (BIG) AUS



Burt's Greenhouses
Ontario, CAN Alex English

100 kWe 2% Char
Calforest, CA

Seed
Screenings

100 kWe 10% Char
Northern Excellence MN

Production for Biochar 75-400 TPD

Urban/Forest Wood

Wheat Straw or
Corn Stover

Wood Char

Retort

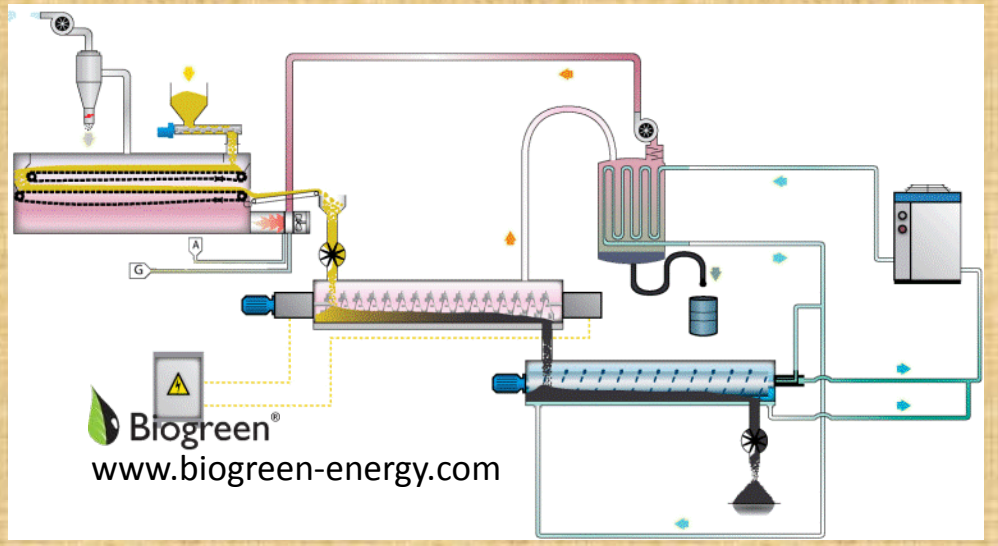
Bioenergy LLC
RUS

Co-production of Biochar and Energy 250-1,000 tpd

Energy and Heat
25 MWe FB Combustor and Boiler (EPI)

Liquid Fuel
50 MGY Ethanol Plant (ICM)

Pyrolysis Oil and Biochar
1-10 tph (Biogreen)



Be Aware of Factors that Affect Biomass Supply

- Biomass Supply subject to variable markets for feed, fiber, fuel and fertilizer.
- Reliable production requires good biomass quality.
- Biomass quality starts in the field or at the stump with the supplier.
- Supplier should attend to the needs of the farmer or landowner.
- Reliable delivery requires fair pricing for:
  - Subsidized feedstocks – urban wood, process residues
  - Field and Forest Residues – wood, straw, stover, cobs and other field crops and residues. ($40-$75/bdt)

Use Biomass Contractors to Secure Stable Supplies

- Large scale contractors
  - 50,000 tpy or more
  - Fleet of trucks, balers and handling equipment
  - Long term contracts
  - Delivered to facility
- Individual Contractors and suppliers
  - 1-6 trucks, loading equipment
  - 1-2 Grinders
  - 5-10,000 tpy
- Individual Farmers and Land Owners
  - Few individual growers organize and sustain supply to industrial plants.

Poultry Litter Has Good Supply and Infrastructure

- Large decentralized supply.
- Collect and store 60,000 tpy
- Haul up to 100 miles with big existing infrastructure
- Preferred soil amendment and fertilizer (N) replacement
- Stable cost and supply
- $20-30/Bone dry tone delivered to year round facility.

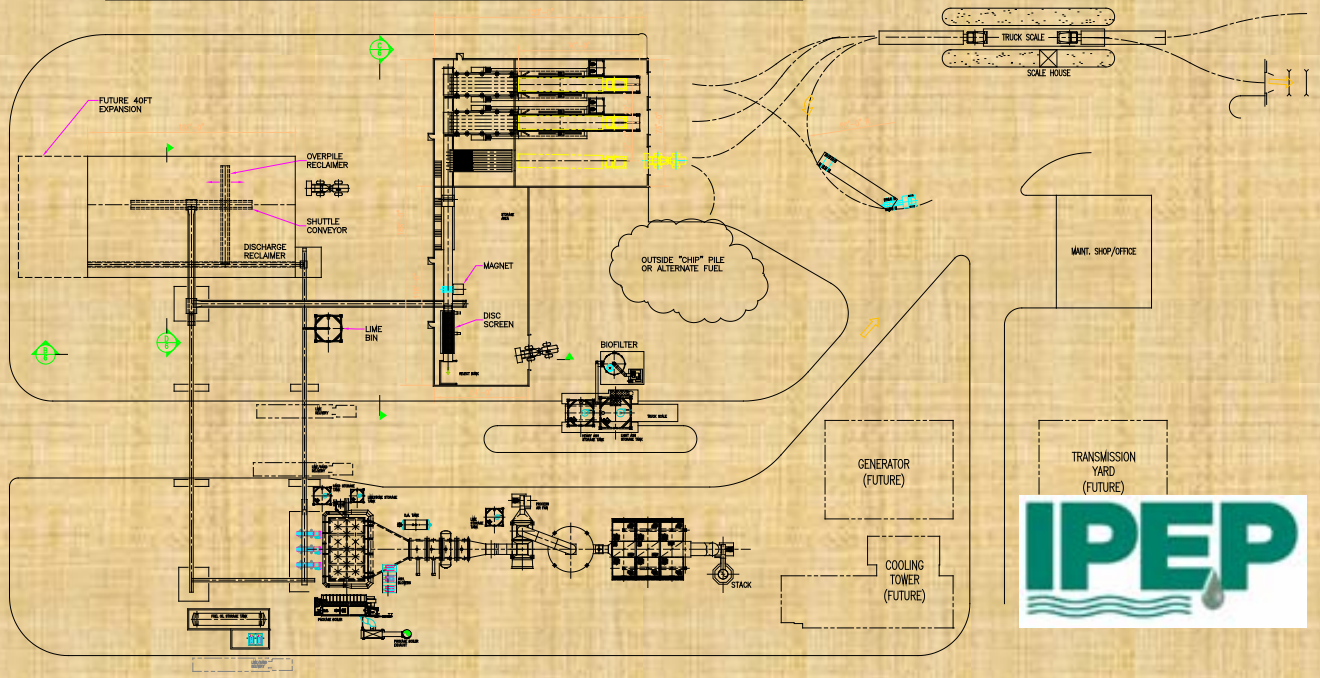
Large Scale Poultry Litter Biochar Production Will Be Similar to Existing Energy Plants

500,000 tpy turkey litter
55 MWe
40,000 homes served
Existing supply, infrastructure and fertilizer (ash) byproduct

Some Operational issues:
- Fuel handling
- Abrasiveness of Litter
- Ash agglomeration
- Controlling Emissions
- Odor in Ash Handling

Fibrominn Biomass Power, MN

Poultry Litter Receiving and Storage for Boiler Plant 150,000 tpy



ISSUES

- Biosecurity
- On Farm Storage
- Many Sources
- Transportation
- Enclosed unloading and storage
- Fire hazard, venting
- Ammonia, pH
- Alternate fuels or steam source

Bales are Primary Package for Ag Residues

1000 lb/bale

Need good maintenance for high production

4,000 ton/baler/year

Bale Stacker

Bales Stored Open, Covered or in Buildings

Temporary Storage
1,000 Tons/Stack

Bale Squeeze Loader Speeds Handling and Processing

BLOCK =6 BIG BALES (3 TON)
56 small bales (2.5 TON)

Other Big Square Bale Handlers

2/4 BALES: 1-2 TONS per load (Chariton Valley, IA)

Automated Cranes Are Used in Europe

Modern Danish Straw Plant

Preprocess Bales in Stationary Debaler/Hammermill

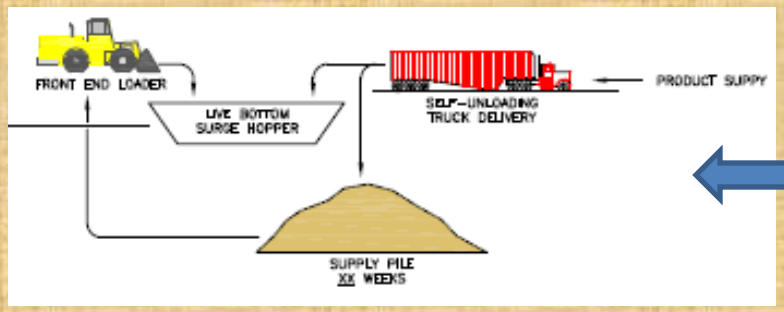
Hammers 30,000 t/set
Screens 20,000 t/set

400 Hp De-baler 12 TPH 2in

Hammer Hog for Coarse Grind

Other Mobile or Stationary Biomass Processing

Biomass Handling



Grind Biomass

Rotor and Screen

Size and MC

Corn Cob Collection Systems are Under Development

BR Bock Consulting

Summary

- Biochar producers should use contractors to secure reliable supply.
- Large and small scale pyrolysis and gasification technologies for making biochar require industrial grade logistics and supply.
- Biochar producers benefit from handling systems that are being developed for similar energy technologies for wood, straw, cobs and stover.
- A few large biomass baling and handling systems are in operation.
- Biochar producers must consider biomass handling, capital and operating costs.

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**