

MORA

MISSOURI RECYCLING ASSOCIATION – ANNUAL CONFERENCE

Biomass Feedstock from MSW Backbone for the Biorefining Industry

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ALTERNATIVE FUELS SESSION

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CleanTech Biofuels

**Garbage In
Energy Out**

Clean Tech Processes Unsorted MSW



From this



Biomass Feedstock & Recyclables



To this ... in three easy steps!



To Maximize Landfill Avoidance



To avoidthis!



Presentation Objectives

Present Game Changing Technology for;

- Producing a Sustainable Biomass Feedstock
- Accomplishing Recycling
- Changing the Waste Management Industry
- Benefiting the Environment
- Providing Industrial Growth & Jobs
- Benefit both Rural & Urban Communities



Biorefining Industry

- Industrial & Municipal Combined Heat and Power (CHP)
- Alternative Fuels and Chemicals

The future of the Biorefining Industry depends on establishing a sustainable, predictable and affordable supply of biomass feedstock.



Biomass Feedstock Source

The Planet is rich in Biomass Resources

- **Agricultural Resources**
- **Forest Resources**
- **MSW Resources**



DOE Goals for Biomass By 2030

- Establish a 1 Billion Ton/yr Biomass Supply
- Replace 30% Of Our Imported Oil
- Produce 5% of Electric Power Demand
- Provide 20% of Transportation Fuels
- Produce 25% of Chemicals



Why Biomass from MSW ?

- Exploits an Extensive, Mature Infrastructure
- Available for Immediate Deployment
- Contains all Essential Qualities for a Biomass Feedstock
- Provides Game Changing Options for a Sustainable Waste Management Industry
- Reduces Waste Management Costs
- Provides Substantial Environmental Benefits



Today's MSW Challenges

- Landfill Crisis
 - Tipping fees: Soaring Costs
 - Closing landfills
 - Mega-landfills
 - Transportation costs
 - Environmental Impacts



Chicago has seven years worth of landfill space available.

Illinois EPA, 21st Annual Landfill Capacity Report



Biomass Supply Chain “Backbone”

- Biomass from MSW can be the “Backbone”
- Widely Distributed Availability
- Available 24/7, 365 at Non-Commodity Pricing
- Mature Infrastructure for Collection & Distribution
- Suitable Feedstock for Most Conversion Technologies
- Can Supply Biorefineries in Urban & Rural Locations
- No Food vs Fuel or Indirect Land Use Change Issues

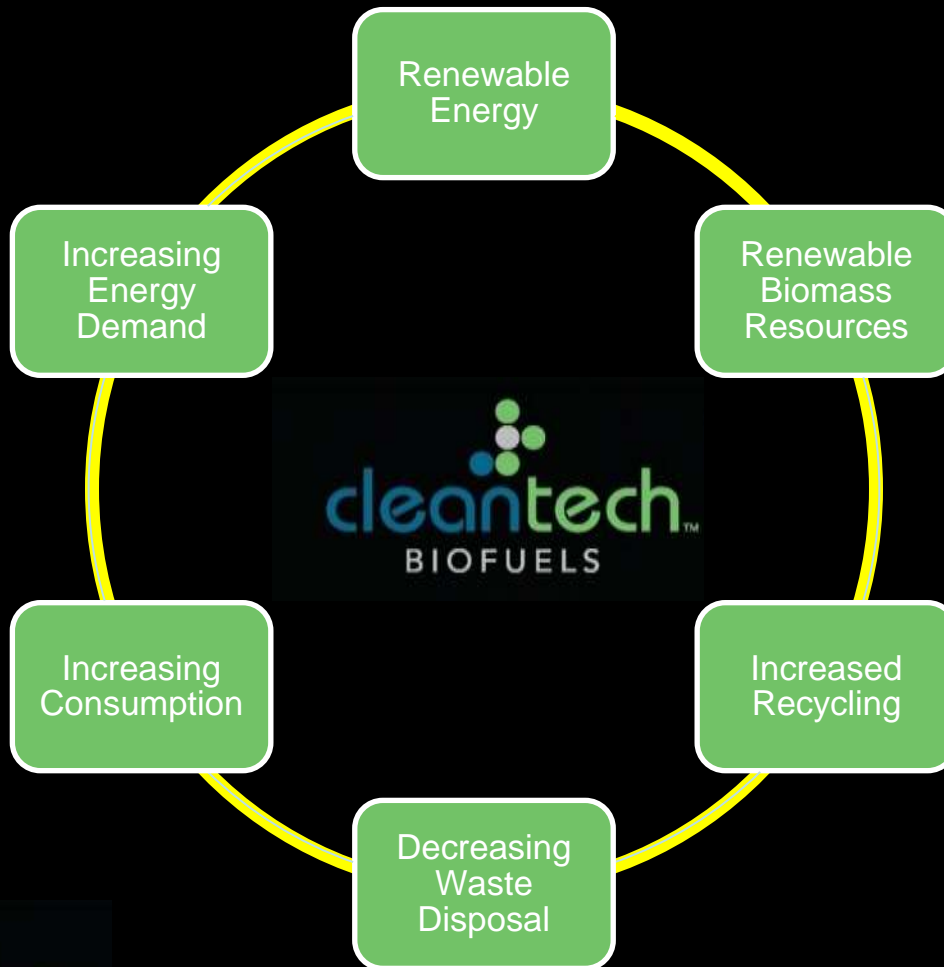


CleanTech Biofuels' Vision

- Provide a Sustainable Biomass Feedstock Infrastructure
- Stimulate Development of All Biomass Feedstocks
- Provide Predictable Costs for Biorefinery Profitability
- Reduce Dependency on Petroleum
- Stimulate Development of Renewable Power, Fuels and Chemicals from Biomass
- Accelerate the Growth of Jobs in the Biorefining Industry
- Maximize Recycling
- Generate Significant Environmental Benefits
- Reduce or Eliminate the Need for Landfills



Tomorrow: Sustainability



MSW Volume and Implications

Estimated MSW Volume

- 260 to 500 million tons annually
- 50+% cellulosic

Assume 100 gal liquid fuel/ton

- MSW could produce 13 – 25 billion gal/yr
- ~ 20% of imports from OPEC



Typical MSW Composition

Ferrous Metals	5.6%
Non-Ferrous Metals	2.0%
Plastics	11.8%
Glass	5.2%
Misc. Inorganics	10.6%
Biomass Bone Dry	48.6%
Water	16.2%
Total	100.0%



Energy & Environmental Benefits

Qty of MSW = 260 Million Tons/yr

Biomass Feedstock (10% Water)	140,400,000	Ton/yr
Crude Oil Equivalent	322,436,000	bbl/yr
Equivalent Diesel Fuel	14,490	Billion gal/yr
Ethanol Equivalent	24,500	Billion gal/yr
Electricity Equivalent	164,300,000	MW/yr
Electricity Equivalent	19,600	MW/hr



Energy & Environmental Benefits

MSW=1 Million Tons/Day

Energy

Avoided GHG

	<u>Tons/Day</u>	<u>MMBtu/yr</u>	<u>MTCE/yr</u>
Ferrous Metals	56,000	291,200,000	7,134,400
Non-Ferrous Metals	20,000	1,076,400,000	19,240,000
Plastics	118,000	1,626,040,000	12,885,600
Glass	52,000	36,504,000	1,081,600
Misc. Inorganics	106,000	0	0
Biomass Bone Dry	486,000	1,870,128,000	
Water	162,000		
Total	1,000,000	4,900,272,000	40,341,600



CleanTech Innovative Solution

Garbage In



Processing



Biomass Out



Recyclables Out



Process Details



From this



Process Details



To this ... in three easy steps!



Process Details



MSW is delivered to a tipping floor and over-sized items are removed.



Process Details



MSW is processed with steam in a cylindrical vessel that separates garbage into its component parts.



Process Details



Biomass feedstock is stored for transport to biorefineries, CHP and power companies.



Coff's Harbor Commercial Facility, Australia



Coff's Harbor Commercial Facility, Australia



Costs

Capital Costs:

~ \$25 to 30 million for a
1,000 ton/day Facility



Operating Costs

~ \$25/ton



Process Economics

Economics depend largely on tipping fee:

- Tipping fees range from \$24/ton to \$75/ton
- National average tipping fee is ~ \$35/ton
- CleanTech biomass production costs: ~ \$25/ton
- Net costs: \$1, to -\$50/ton; Average is -\$10/ton
- The specific project business model will dictate the ultimate profitability & customer cost.

NOTE: With no government subsidies!



Costs of Other Feedstocks

Wood chips: \$40+/ton



Agricultural crops: \$65+/ton
(e.g. switch grass)

Corn: > \$200/ton



CleanTech Biomass: (Negative Internal)



Commercial Strategy

- Develop Multiple Revenue Streams:
 - Tipping fees
 - Biomass Sales
 - Electricity/Steam Sales
 - Recyclable Sales
- Develop Biomass Plants via Public-Private Partnerships
- Develop Integrated Business w/Fuels or Chemicals Technology
- Promote Future Global Expansion



Summary

- Game-changing, proprietary technology
- Sustainable Backbone for Biorefining Industry
 - Provides Economic Biomass Feedstock Supplies
 - Generates Significant Environmental Benefits
 - Stimulates Growth of Biorefining Industries
- Maximizes Recycling
- Reduces Dependency on Foreign Oil
- Job and Industry Growth for Rural & Urban Areas





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