Emerging Trends in Biomass Energy

Agricultural Utilization Research Institute

CERTs 2011 Clean Energy Convergence

February 3, 2011

St. Cloud, MN

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AURI

- Nonprofit agricultural research institute
- Applied research and technology transfer
- Created to develop new uses for Minnesota agricultural products and co-products
- Emphasis on innovative new uses
  - *Food products*
  - *Industrial products*
  - *Personal care items*
  - *Bio-products*
  - *Renewable Energy*

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Applied Research

- Private research and development service focusing on value-added opportunities for Minnesota companies and entrepreneurs
- Laboratory facilities and accompanying expertise across the state
- Starting point – "economic analysis"
- Multiple biomass projects
- Wide range in project scale

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Focus: Emerging Trends in Biomass Energy

- Market Potentials……is it real?
- Project/Initiative Examples
- Economics
- Scientific Challenges/Future

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Market Potential – Is it real?

- Biomass offers best opportunity if replacing propane or fuel oil
- Success depends on control over feedstock
- Greater biomass efficiency when utilized for thermal requirements
- Culture vs. economics – focus on fuel independence and pollution
- Focus on ***local*** and light commercial projects

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Market Potential – Is it real?

Needs:

- Technology improvements…on-going
- Market incentives with action plan
- Potential mandates
- Permitting

Market Potential

- Biomass → Combined Heat & Power
- Biomass → Ethanol (Cellulosic)
- Biomass → Methane
- Biomass → Pellet Fuels
- Biomass → Co-Firing

Alternative Energy Solutions

- On-farm biomass pellet manufacturing
- Utilizes crop residue, grasses, processing waste, wood waste
- Pellets combusted in boilers

Alternative Energy Solutions

- Heats 65,000 sq ft of greenhouse
- Reduces energy costs by about 50%
- Uses 500-600 tons pellets/year

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Northern Excellence Growers

- Grass seed growers in NW Minnesota
- Timothy, rye grass, bluegrass, others
- Produce 8 million pounds of seed, generate 2 million pounds of screenings

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Northern Excellence Growers

- 100 kw gasification system powered by screenings
- Saves company $60,000/year in disposal and energy costs
- System in process of commissioning

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Chippewa Valley Ethanol Cooperative

- Corn cobs serve as biomass to feed gasifier
- Offsets thermal energy needs

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Biomass Pellet Fuels

- Minnesota companies focusing on biomass pellets for home or light industrial applications
- Utilizing wood waste, Ag residue, Ag processing co-products, corn
- Benefit: Feedstock consistency

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Biomass Pellet Projects

- Individuals and industry focusing on small scale production for office, machine shops and schools
- Pellet fuel blends designed for desired energy and ash content.
- Specific to combustion technology utilized.

Project Initiatives

- Addresses emerging industry wide opportunities
- Public information related to applied and tech transfer research
- Technical and economic feasibility

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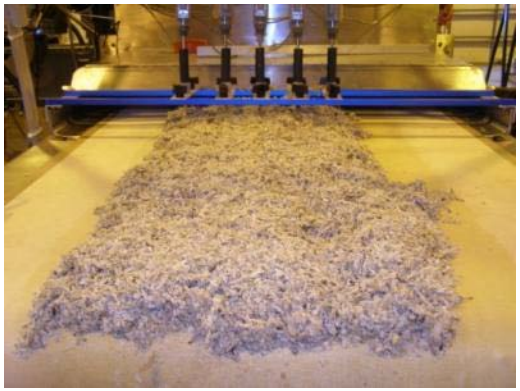
Biomass Initiative Examples

- Biomass Pellet Plant Feasibility Study Guide
- County Biomass Assessment Template
- Biomass Burner Initiative
- AURI Fuels Initiative
- Biomass Ash Initiative



Biomass Ash Initiative

- Need:
  - *Identify value-added potential to utilize ash sources for corn production.*

- Focus:
  - *Identify P and K availability for corn production from **ash derived from direct, fluid bed, and gasification technologies.***
  - *Identify technologies capable of densifying these ash materials*

Biomass Economics – Is it cost effective?

Product	Avg.Btu/unit	Units	MM of Btu	Retail cost	Cost/unit	Efficiency	Cost per MM Btu
Coal - bituminous	11,100	lb.	0.0111	$40/ton	$ 0.0200	0.5	$ 3.60
Electricity	3,413	kWh	0.003413	4 cents/kWh	$ 0.0400	0.97	$ 12.08
Electricity	3,413	kWh	0.003413	8.2 cents/kWh	$ 0.0820	0.97	$ 24.77
Natural gas - Ind.	1,028,000	1,000/ft cu.	1.028	$5.00/1000 ft2	$ 5.0000	0.8	$ 6.08
#2 fuel oil	140,000	gallon	0.14	$3.00/ gal.	$ 3.0000	0.8	$ 26.79
Propane	91,333	gallon	0.091333	$1.65/ gal	$ 1.6500	0.8	$ 22.58
Wheat Straw	7,700	lb.	0.0077	$60/ton	$ 0.0300	0.7	$ 5.57
Corn Stover	7,604	lb.	0.007604	$75/ ton	$ 0.0375	0.7	$ 7.05

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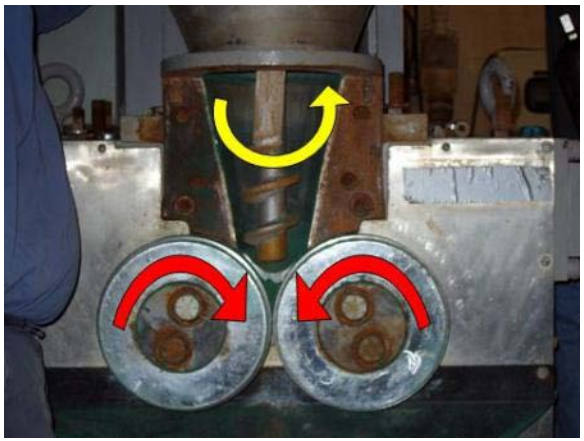
Economics of Densification

- **#1 – Is densification necessary?**
- Material cost
- **Collection/transportation cost**
- Grinding/processing
- Pelleting/cooling
- Storage/bagging
- Personnel/equipment
- Fluctuating fuel market
- Debt service

Economics of Densification Assessment

- Focus on different densification technologies throughout the world.
- One of the largest obstacles facing biomass utilization.
- Densification standardize feeding mechanisms for gasifier and other biomass based systems.



Economics of Pellet Production

(Basic Equipment Capital Cost Only)

	Wood		Ag Residue	
Throughput:	14 TPH		22.4 TPH(160%)	
	Pelleting	Briquetting	Pelleting	Briquetting
Est. Capital Cost per Ton:	$56	$64	$32	$45
Est. Hp/Ton per Hour:	179	118	112	89

Source: Biomass Densification Evaluation Report; www.auri.org

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Economics of Pellet Production

- Drying Cost
  - *Typically 1,400 – 2,000 Btu required per pound of moisture removed*
  - *63% moisture to 13% moisture = 50%*
  - *1,000 lbs water X 1,600 Btu= 1,600,000 Btu*
  - *1.6 MMBtu X $9.00/MMBtu = $14.40*

    $28.80 */ 2,000 pounds @13% moisture*
- Focus on more efficient drying technology

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Scientific Challenges / Industry Needs

- Efficient methods for transportation/collection
  - *Biomass collection equipment improvements*
  - *Torrifaction?*
- Reliable sources for biomass
  - *Producer cooperatives for supply*
  - *Reduced price fluctuations*
- Governmental action
  - *BCAP*
- Emissions
- Liability
- Ash handling

Tools Available for Biomass Project

- **AURI Renewable Energy Template**

  - estimating the renewable energy potential and energy demand for a county or region

- **AURI Biomass Pellet Plant Feasibility Guide**

  - evaluation examining challenges and competitive disadvantages that new businesses marketing Ag-based biomass pellets could face

- **AURI Fuel Initiative**

  - agricultural commodity and co-product evaluation for energy characteristics

- **Small-Scale Ethanol Feasibility Study**

  - provides an outlooks for small scale ethanol production

- ***Many more at www.auri.org***

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Moving Ideas to Reality

- Renewable Energy Roundtable
  - *Ensures Minnesota is a recognized leader in renewable energy knowledge, application, and utilization.*
  - *Create an implementation platform for moving short and long-term strategic action forward between public and private sector in academics and industry.*

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Moving Ideas to Reality

Innovation requires……

implementation

Thank You!

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