

Biomass Gasification at Chippewa Valley Ethanol Co.

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**Heating the Midwest Conference
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Chippewa Valley Ethanol

- Chippewa Valley Ethanol Co. (CVEC) is a 48 million gallon per year fuel ethanol producer
- Also produce specialty and organic ethanol for food and cosmetics plus ultra-clean ethanol for Prairie Organic and Shakers vodka
- 53 employees
- Co-op: 980 Farmer and local community owners located in rural SW Minnesota
- Producing ethanol since 1996



Why Biomass at CVEC?

- **Energy cost hedge**
 - NG vulnerable to wide price fluctuations
 - Future energy costs will be high
 - Carbon monetization will increase fossil fuel cost
- **Carbon & the Environment**
 - Clean energy supplier (reduce GHG emissions)
 - Earn and sell carbon credits
 - Low carbon footprint ethanol = premium value fuel?



Why Biomass?

- **Create a local biomass market**
 - Provide a new revenue stream for Co-op farmer owners
 - Opportunity for local biomass suppliers
 - Spend our \$10mm to \$15mm for heat energy locally
- **Sustainable and responsible**
 - Woody residue, corn cobs, straw, and switch grass require minimal additional input to gather
 - Soil quality is maintained and erosion is controlled



Corn Cobs & CVEC

- **Corn Cob Field-to-Facility Project 2008**
 - 3,300 acre corn cob collection yielding approximately 1,500 ton
 - 3 demonstration days at differing locations
 - Two cob harvesters (Ceres and Vermeer)
 - Feasibility study, outreach brochure & video
- **2009 Corn Cob Collection**
 - 7 Vermeer cob harvesters
 - 12,000 to 14,000 acres & 6,000 to 8,000 ton
 - Biomass Crop Assistance Program (BCAP)
 - CVEC is a Certified Biomass Conversion Facility

Corn Cobs & CVEC

- Corn cob moisture was 30% to 40% versus CVEC target of < 20%
 - Rule of thumb; Cob moisture = 150% of corn moisture
- In 2009; \$56/ton covered harvest, haul and grind (delivered ground to CVEC). If the farmer needs \$14 profit/ton for motivation then \$70/ton delivered (\$56 + \$14) was minimum value to sustain cob supply chain in 2009.
- CVEC incentivized 2009 cob harvest by offering to pay \$80/ton (\$40/ton BCAP contribution)

Corn Cobs & CVEC

- CVEC negotiated \$60 payout for unprocessed tons after BCAP collapsed, which basically covered the farmers delivered cost. CVEC paid \$60/ton versus the original budget of \$40/ton.
- Purchase price of the cob harvester is a major hurdle for farmer ownership due to the limited acres a typical farmer will cover. 3,000 acres use is desirable for investment payback.



Corn Cobs & CVEC

- CVEC rule of thumb from 2009
 - \$10/ton cob value competes with \$1/mmbtu NG
[example, if NG is \$6/mmbtu then CVEC must pay less than \$60/ton to justify gasifying cobs.]
 - 1 acre will pile store about 1,000 ton of cobs
 - 0.7 ton of cobs per acre
- Cobs stored well and gasified well, we like cobs
- No cobs collected in 2010 or 2011 due to low natural gas prices







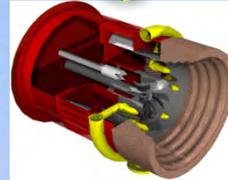
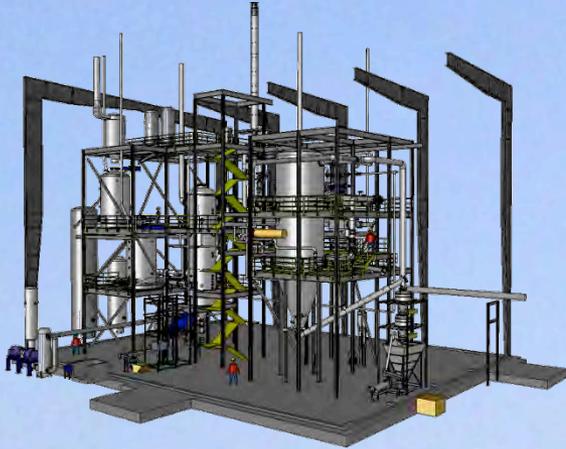
Why Gasify?

- **Frontline BioEnergy – Best technology for repowering a plant**
 - **Keep existing NG equipment**
 - Using existing equipment is more cost effective than installing **new stand alone biopower**
 - Minimal impact during plant integration
 - Instant robust natural gas back-up
 - Disruption free operation of existing ethanol plant

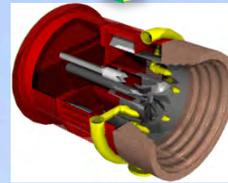


One Gasifier → Many Multi-fuel Burners

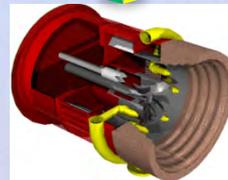
FRONTLINE BIOENERGY
GASIFIER



DRYER



BOILER 1



BOILER 2

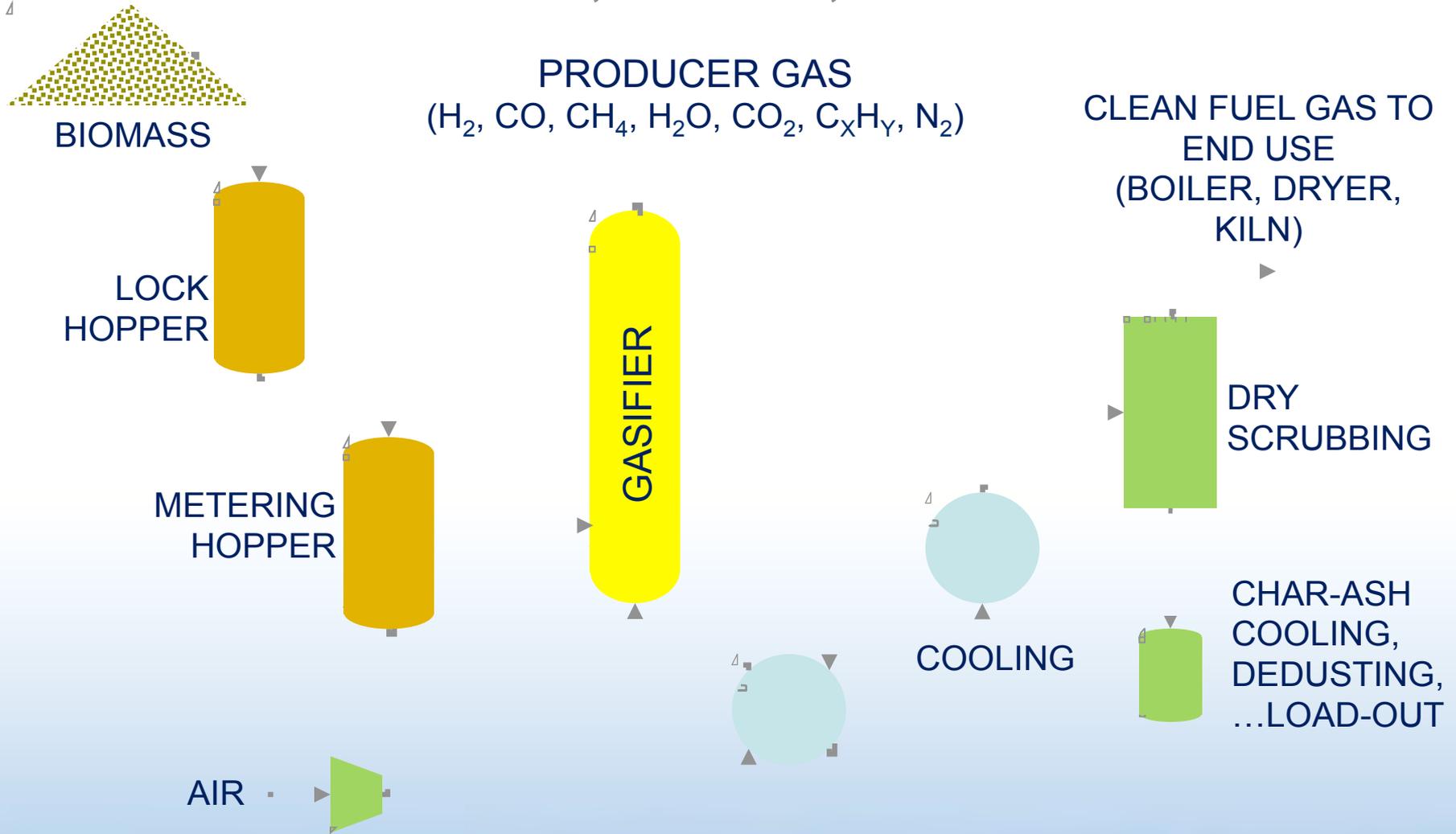
MULTI-FUEL BURNERS

NATURAL GAS



PMFreeGas™ Gasification System

Ultra Low PM, Low Alkali, Low Chloride Gas



Results

- Producer gas to Boiler #3
– April 9, 2008
- 7,260 tons Wood gasified
- 6,540 gal. Glycerin gasified
- 770 tons Corn Cob gasified



Construction at CVEC
August, 2007





Some Biomass Advice

- **Source it close:**
 - Minimize transportation fuel costs moving low density biomass
 - Research and know what biomass is available within 20 miles, within 60 miles
- **Keep it real:**
 - What biomass moisture can you tolerate? Do your homework and know the range of moisture the harvested biomass may contain (high and low)
 - How much space do you need to store biomass? Many acres of storage are required due to the seasonal nature of biomass harvest and the low density of biomass

Some Biomass Advice

- **Keep it real:**
 - Examine how the biomass needs to be stored to maintain its quality and to facilitate piling and reclaim. This includes paving or storage pad drainage, chopping, grinding, aeration, drying, shelter, frontend loaders and conveyors
 - High volume, live bottom semi trailers work best for chopped or ground biomass, do local haulers have these trailers?
 - Equipment required to harvest the local biomass? Availability and cost to own and operate?



Some Biomass Advice

- **Keep it real:**
 - Logistics: Is biomass harvest occurring at the same time as crop harvest? Is there adequate manpower and machinery to accommodate biomass harvest?
 - BCAP: Short term help, an excellent idea to get the ball rolling but the business must be sustainable without it. BCAP funding?
 - Plant gate delivered cost of biomass? Keep in mind a farmer may need \$10 to \$25 dollars of profit per acre to make it worth their effort.
 - Air permitting is slow, expensive and complicated if you plan to combust biomass.

Chippewa Valley Ethanol Co.

