ETHANOL BIOFUEL

Steve Murphy
General Manager
POET Biorefining - Laddonia
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POET BIOREFINERY LOCATIONS

1. Scotland, SD
2. Bingham Lake, MN
3. Preston, MN
4. Glenville, MN
5. Macon, MO
6. Big Stone, SD
7. Coon Rapids, IA
8. Caro, MI
9. Chancellor, SD
10. Groton, SD
11. Hanlontown, IA
12. Ashton, IA
13. Hudson, SD
14. Emmetsburg, IA
15. Lake Crystal, MN
16. Jewell, IA
17. Gowrie, IA
18. Laddonia, MO
19. Mitchell, SD
20. Corning, IA
21. Portland, IN
22. Leipsic, OH
23. Alexandria, IN
24. North Manchester, IN
25. Fostoria, OH
26. Marion, OH
27. Cloverdale, IN

TOTAL GALLONS REPRESENTED: 1.6 BILLION
Corn Draw Area
LADDONIA PLANT FACTS

• Began operation Sept. 26, 2006
• We operate 24/7 and year round
• Majority Missouri farmer-owned through two co-ops (80%)
  – POET is a minority owner, but provides technology and management
• 43 employees and $180MM in economic activity for Audrain county
How We Make Ethanol and Biorefined Products

The process of making ethanol starts here on the farm:

1. Harvest corn
2. Hammermill
3. Sucrose to fructose
4. Fermentation
5. Yeast and enzymes
6. Distillation
7. Whole stillage
8. Dryers and thermal oxidizers
9. Livestock feed
10. Syrup

Result:
- 200 Proof ethanol
- Denaturant
- Motor vehicle fuel (cleaner, more efficient)

POET
Energy inspired.
ENVIRONMENTAL INNOVATIONS

• 15Meg Heat Recovery Steam Generator (HRSG) turbine supplies steam to distillation and electricity to the grid
• In-line blending of denaturant
• All process water has always been recycled – Total Water Recovery – recycles RO reject water
• Corn Oil Separation for biodiesel and feed
• CO2 capture for food, beverage, industrial
POET WATER USE REDUCTION

80% reduction since 1987
OLD LEGISLATIVE ISSUES

Changes already in effect

• VEETC Blenders credit was allowed to expire on January 1, 2012

• Tariff on imported (Brazilian) ethanol also expired on January 1, 2012

• Small Producer Tax Credit expired 1/1/2012

• All ethanol industry subsidies ended in 2011
  • Only RFS2 remains
NEW LEGISLATIVE ISSUES

Legislation/regulations in progress

• Blend wall – E15 and blender pumps
  – US Market saturated at 10% ethanol
  – EPA has approved E15 for vehicles 2001 and newer, but rollout has been slow
  – Ethanol is currently selling at over $0.70/gallon discount to gasoline
  – Shortage of RINs and increase in RIN price has been in the news recently
  – NASCAR in third season with E15
LEGISLATIVE ISSUES

• “Indirect Land Use Change” – controversial theory that claims corn used for ethanol in America kicks off a chain reaction that leads to global deforestation.
  – 30% to 50% of corn ethanol CO2 is from ILUC
  – Forecast models of this theory do not match actual historical data
  – Deforestation in Brazil and elsewhere has declined while ethanol production has increased
  – Ethanol is targeted as a cooking fuel replacement for charcoal in Africa
LEGISLATIVE ISSUES

• RFS2 – blending requirements for ethanol and other biofuels – 36B gallons by 2022
  – Being targeted for repeal by opponents
  – 15B cap for corn ethanol

• Three categories of biofuel
  – Corn ethanol / biofuel – 20%
  – “Advanced” biofuel – sugar cane, milo – 50%
  – Cellulosic ethanol – corn stover, wood
LEGISLATIVE ISSUES

• Corn ethanol and Advanced biofuels
  – Corn ethanol cannot be considered an “advanced” biofuel regardless of carbon intensity under RFS2 rules

• RFS2 pathways approved to show 20% GHG reduction for RINS
  • 90%+ of steam from CHP
  • 90%+ raw starch hydrolysis
  • Corn oil extraction at 1.33 lbs/bu
  • Wet vs. dry distillers grains (50% or 65% + 1)
CELLULOSIC

• 266MM gallons of cellulosic and other advanced biofuel capacity is under construction for 2014 SOP at a cost of $2.7B
• POET Biorefining – Emmetsburg has broken ground for 20MM gallon co-located cellulosic ethanol refinery using corn residue (Project LIBERTY)
• Emmetsburg forecast to be a net carbon sink consuming 111% of life cycle emissions
ETHANOL FACTS

- Ethanol is lower in BTU content, but 113 octane
- Blended with lower grade gasoline
- EPA still uses test fuel from 1970’s (Indolene)
- Current engines are designed to tolerate ethanol, not optimized to use it
- Auto industry moving to smaller, higher compression, turbo engines
- Ethanol has reduced / eliminated farm subsidies
- Ethanol is using 40% of corn in 2012 due to drought, but puts back over 50% via DDGS
- Co-products are key in “Food vs. Fuel” and carbon intensity calculations
ETHANOL FACTS

– Ethanol does not displace gasoline, it displaces the high octane portion of gasoline and lowers fuel costs (toluene @ $4/gal vs. ethanol @ $2.40/gal)

– Ethanol (C2H5OH) is 52% carbon

– Toluene (C6H6CH3) is 89% carbon

– Ethanol displaces carcinogenic BTX compounds

– Oxygenate for better combustion (less particulate)

– Biodegradable – no beaches ever closed due to ethanol spills

– Tier 3 fuel rules proposed by EPA on Good Friday
  • Lower sulfur – 10 ppm from 30 ppm
  • E15 with higher ethanol option to replace indolene
  • Effective in 2017
ASSUMPTIONS USED ARE KEY

– How many bu/acre for corn?
– How many ethanol gal/bu?
– How are DDGS treated in energy balance?
– ILUC assumptions?
– What year is baseline data?
– How is rain treated in water use?
– Where do carbon inputs start and stop?

• Is having the US Navy in the Persian Gulf a subsidy for the oil industry?
• Oil spills and clean up?
• Should these be included in oil carbon intensity?
ETHANOL SUMMARY

• By selectively choosing facts, you can make ethanol look extremely positive or negative
• Industry is still very new (<10 years)
• Oil and food industries have a lot more money to get their message out than does ethanol
• Do not take everything you hear in the news as the full story
  – Ethanol is complicated energy policy not easily summarized in a few minutes
  – Most news has an opinion now (Fox, MSNBC, etc.) and only tells one side of the story