Montana Fuel Ethanol Basics

Howard Haines
Bioenergy Engineering Specialist
Montana Department of Environmental Quality
Air, Energy & Pollution Prevention Bureau
EQC Energy Policy Subcommittee
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Points to Cover-Montana EtOH

- What is fuel ethanol
- Montana Background & Use
- Challenges to development
- Montana projects
- Air and Water quality
- Future Directions

What is Fuel Ethanol

- Ethanol = grain alcohol, moonshine
- Dried, no water at all
- Denatured)usually with unleaded)

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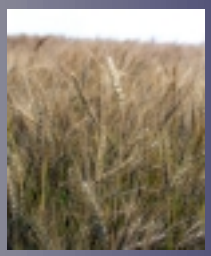
Traditional Biomass Feedstocks for Ethanol Production

Corn

Sugar cane



Wheat

Potatoes
Sugar beets

HISTORICAL PRODUCTION AND USE IN MONTANA

- First plant started production 1980

PAST MONTANA PRODUCERS

- AE Montana, Manhattan
- AlcoTech, Ringling
- Bronec Fuel, Geraldine
- AgriFuels of Polson, Polson
- Sage ‘n Cedar, Terry
- Southwest Alcohol Producers, Dillon

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WHAT WERE/ARE THE CHALLENGES

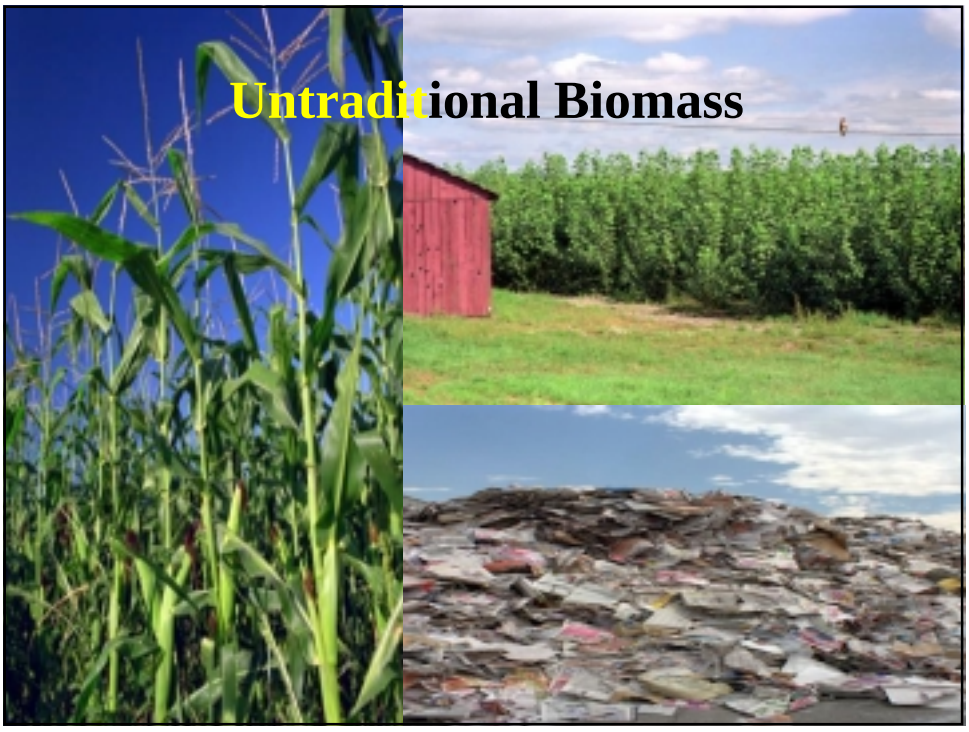
- Financial (under capitalized)
- Marketing of products profitably
- Consumer education
- Management
- Conflicting regulations (BATF vs EPA)

DEQ-DNRC Activities

- Assist financing
- Lower energy processes
- Less expensive feedstocks
- Educational demonstrations
- Market assistance in AQ hot spots

PAST MONTANA STUDIES

- Ambient temperature starch hydrolysis (ATSH), RTI, Butte
- Solar assist distillation (BEI)
- Combined solar greenhouse, digester and ethanol plant: Conrad
- Assessment of MT grain to ethanol (MSU)



PAST MONTANA STUDIES

- Auto-hydrolysis of lingo cellulose (MSU)
- Dilute acid hydrolysis (BEI)
- MultiTech--Anaconda-Butte Madison conversion process

PAST MONTANA STUDIES

- Assessment of Feedstocks in MT MSU
- Ambient Temperature Lignocellulose Enzymatic Hydrolysis (RTI) (Montana Microbial Products, Missoula)

ETHANOL BLEND IN MONTANA

- E-10: 10% ETHANOL, 90% GASOLINE
- E-85: GENERIC NAME WITH 50-85% ETHANOL BLEND WITH GASOLINE, LESS ETHANOL IN WINTER
- E-8 8% ETHANOL, USED IN MISSOULA

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Ethanol Fuel Benefits

- High octane
- Clean water supply
- Cleaner air
- Secure fuel supplies
- No net CO2 emissions
- Attractive costs

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Air Quality and E-10

- Reduces emissions including
- fine particulate matter (PM 2.5)
- hydrocarbons (HC),
- carbon monoxide (CO),
- volatile organic compounds (VOCs),
- air toxics
- especially in SUVs, RVs, light duty vehicles, and 2-stroke engines

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ETHANOL BLEND EMISSIONS

FUEL	E-10	E-85
CO	-11 to –25%	-38 to -85%
HC	-36%	-57 to –65%
PM 2.5	-25%	-48 to -60
TAC	-22%	-58%
Benzene	-11 to -25%	-62 to -95%

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E-85 in SNOWMOBILES Compared to E-10

	4-stroke	2-stroke
C0	-37%	-78%
HC	-50%	-98%
PM	-58%	

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E-10 BLEND IN MONTANA

- YELLOWSTONE & GLACIER NATIONAL PARKS
- YELLOWSTONE PARK SERVICE STATIONS (CONOCO)
- XANTERRA
- NUMBEROUS SERVICE STATIONS
- MISSOULA CITY/COUNTY AIR SHED
- WEST YELLOWSTONE (WINTER)

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Ethanol Blend Fuels in the Yellowstone Region

- Every million gallons of 10 percent ethanol blend burned reduces potential emissions of carbon monoxide by 61 tons

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YELLOWSTONE-TETON CLEAN CITIES COALITION

DOE program to encourage use of cleaner alternate fuels and vehicles by providing funds to offset costs

Greater Yellowstone-Teton Clean Cities

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The Stakeholders

E-85 in YELLOWSTONE REGION

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Ethanol and Water Quality

- Ethanol blend fuel does not have the water quality problems of MTBE
- Several detects of MTBE in Montana water supplies

STATUS and POTENTIAL

- MTBE Phase out in CA, WA
- Potential to help with lower CO and fine particulate matter reductions
- National security and
- Rural economic development

STATUS and POTENTIAL

- GF proposed plant has permits, gluten +100 million gallons/year
- Plants proposed for Hardin, Huntley, Miles City, Scobey, Shelby, Kalispell, Butte

DEQ Fuel ethanol-related Activities

- US DOE Pacific Regional Bioenergy State Partner Program
- Clean Snowmobile Challenge
- Montana Ethanol Conference, June 13-15, 2004, Helena
- Harvesting Clean Energy V, Great Falls, Jan 9-10, 2005

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Potential and Future

- Biofuels will make greater contributions to our fuel needs in this century.
- 10-15 Mgpy combined plants for MT
- Biorefineries will combine ethanol production with other products like meat
- Future processes will make other products from wheat and cellulose including plastics, chemicals.

THE END

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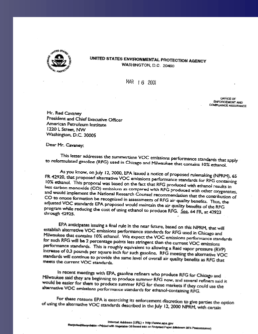
Air Quality and E-10

- Approved for summer use in Chicago and Milwaukee to reduce CO and haze with little or no impact to ozone



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Air Quality Concerns

- Toxic air pollutants (TAP)
  - Can cause cancer or other serious health problems
  - EPA regulates benzene, formaldehyde, acetaldehyde, 1,3 butadiene, and polycyclic organic matter

Air Quality Concerns

- Ozone – a summer problem
  - Harsh irritant that causes respiratory problems and can inhibit plant growth
  - Precursors are VOCs, NOx, and CO
  - Not a Montana concern at this time (climate)

Air Quality Concerns

- Carbon monoxide – primarily a winter problem
  - Inhibits the bloods capacity to carry oxygen and causes a variety of health problems

Clean Air Act Programs

Reformulated Gasoline (RFG)

- Required in areas with ozone problems
- Standards for VOCs, NOx, and TAP
- Minimum 2.0 weight percent oxygen and maximum one percent benzene
- Has achieved an over compliance in TAP reductions, which EPA attributes in part to use of oxygenates

Acetaldehyde and PAN Emissions

- Other components of gasoline, such as aromatic compounds and olefins, are primarily responsible for the formation of formaldehyde and PAN, because of their greater abundance in gasoline and their shorter atmospheric lifetimes.
- Results apply to complying California RFG3, other areas may have different meteorological conditions, etc.

High Emitters and Ethanol

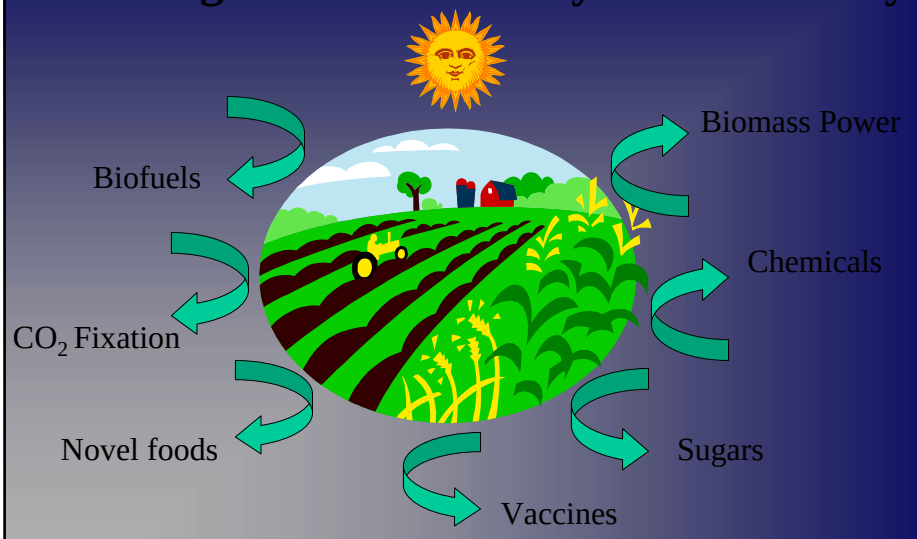
For high emitters, the EPA emissions model (Complex Model) estimates:

- Significant reductions in NOx emissions
- Large reductions in exhaust benzene and 1,3 butadiene emissions

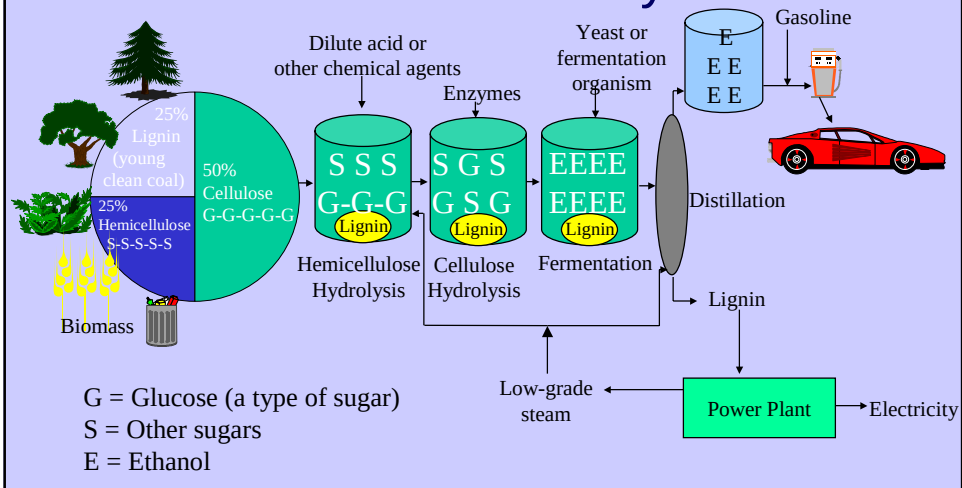
NOx Emissions and Oxygenates

- EPA: a small decrease for all vehicle due to the reduction in NOx emissions from high emitters
- California: an increase in NOx emissions -- high emitters are not separately identified

Paradigm Shift - Carbohydrate Economy



Biomass-to-Ethanol Technology Pretreatment/Enzyme



G = Glucose (a type of sugar)
S = Other sugars
E = Ethanol

Summary

- **Livestock industry has incentives to find new ways to do business with new CAFO regulations**
- **Patented PRIME method technology enables permittable & cost effective integration of ethanol, biogas & cattle/dairy operations**
- **Reduction of CO2, methane, & nitrous oxide emissions will also generate GHG credits as trading regimes emerge**

Biorefineries --The Future

- If we take into account:
  - The land mass of the world
  - All biomass waste streams -- human, animal and trash
  - The great biomass potential of all oceans, seas and bays
- If we appreciate that needed technologies are here today or just around the bend
- If we had needed public support and the political will --

America could lead the world in conserving precious natural resources, generating new basic industries and quality jobs, stabilizing greenhouse gases, enhancing the environment, boosting wildlife and fisheries and their diversity while protecting and preserving God's creation