

Montana Transportation Fuel

Retail Sales 2004 mgpy

Gasoline	500
Diesel (highway)	220
Diesel (dyed)	150

Montana Ethanol Feed Stocks

	mgpy
n Feed Barley/low value grain	80-100
n Sugar beets	50
n Grain Straw (50%)	280
n Energy crops, perennial grasses	>500

Economics

- n Collection Cost
- n Pretreatment to remove lignin
- n Cellulase enzymes cost
- n Dilute ethanol to distillation column

Estimated Costs

Ethanol Production from Grass Seed Straw

ⁿ <u>Input</u>	<u>\$/unit</u>	<u>Cost \$/tonne Straw</u>
Straw	20/tonne	20
MMP Cellulase	0.83/kg	27
Energy		10
Chemicals		11
Fixed cost		5
TOTAL Operating Cost/tonne		73

Ethanol Yield: 61 gallons/tonne straw

Ethanol cost: \$1.20/gallon

Sensitivity Analysis, Straw, and Enzyme Cost

<u>Input</u>	<u>Low Cost Estimate</u>		<u>High Cost Estimate</u>	
	<u>Unit Cost</u>	<u>Total Cost</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Straw	10	10	30	30
Enzyme Dose	5%		10%	
Cost \$/kg	.62	13	.90	40
Other Cost		27		27
TOTAL cost/tonne		50		97
Ethanol cost \$/gallon		.82		1.59

Montana Microbial Products

Enzymes for Biomass Conversion

- n Amylase:
 - n "No cook" starch to ethanol
- n Cellulase
 - n Low cost mixed function preparations for "real world" cellulose
- n Innovative technology for fungus culture, enzyme production