

Introduction to Biodiesel & Oilseeds in Montana



Oilseed & Biodiesel Workshop

Billings, MT January 9, 2008

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Quality**



Opening Slide

Biodiesel can be produced from Montana oilseeds, providing a new crop for rotation and bioproducts that benefit the environment. In any given year, there may be 5-million acres to plant oilseeds in a 3-year rotation with wheat or barley. Such a rotation is proven to increase grain yields. Biodiesel is the bottom of the value chain, as oil from Montana oilseeds can also be used for culinary, cosmetic, and lube oil markets. Fuel is the low-value market.

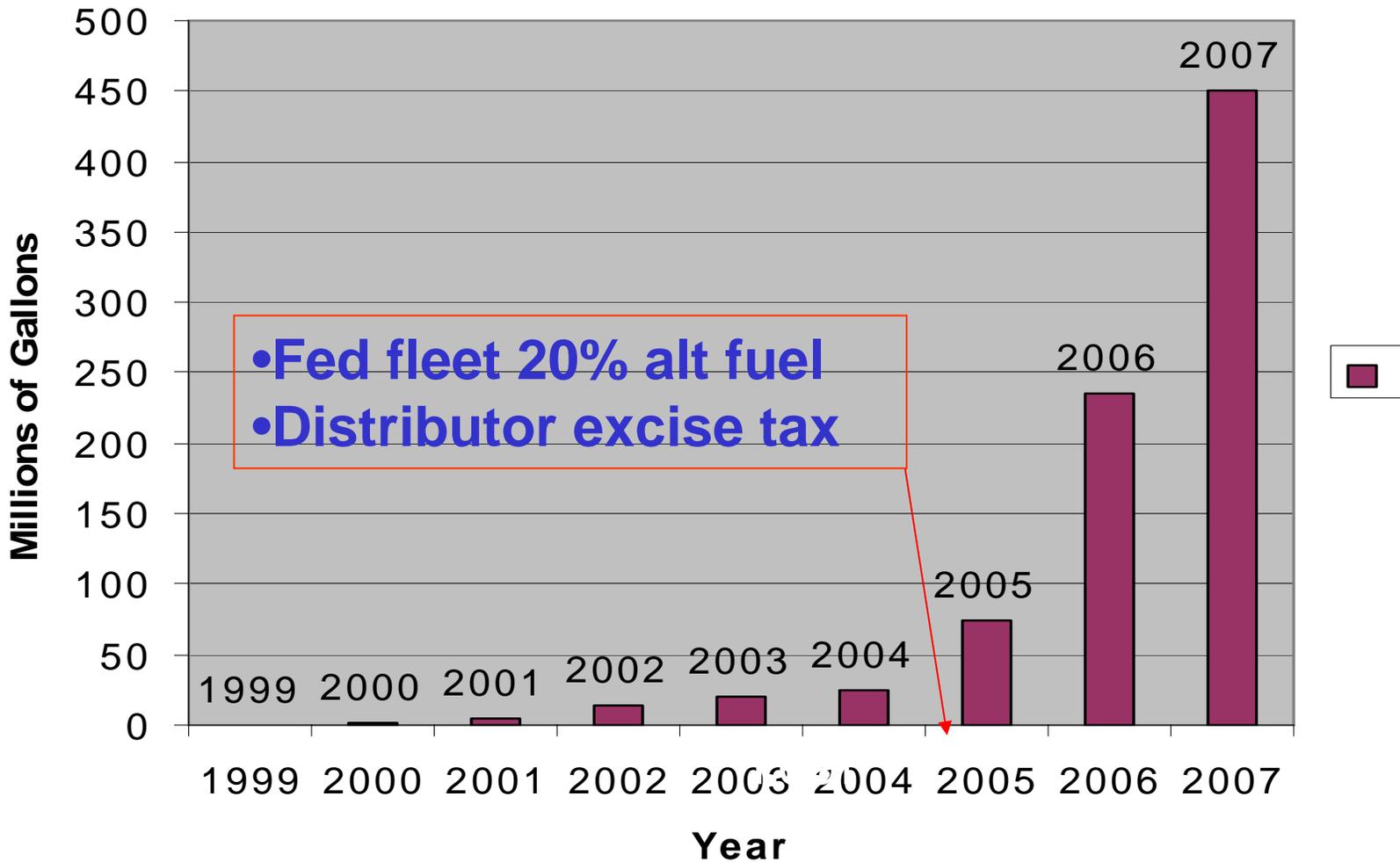
Presentation Overview

- **What is biodiesel**
- **Oilseed Value Chain**
- **Benefits, Challenges**
- **Implications for Rural Montana**
- **Workshop Coverage**



National Biodiesel Growth

Estimated Biodiesel Use



Biodiesel Commercial Use:

- **National biodiesel sales:**
 - 2007 = 450 million gallons
 - 2006 = 235 million gallons,
 - 2005 = 75 million gallons, and
 - 2004 = 25 million (B-100).
- **165 operating plants, 80 under construction**
- **1.85+1.37 billion gallon/yr capacity** (ref NBB web 9/07) **NBB Goal is 1.85 billion gallons PRODUCED (B5) by 2015**
- **Price: Growth due to oil price rise. In many parts of the country, biodiesel is priced below petroleum-based diesel fuel.**

Biodiesel Use (11 stations, 7 fleets)

State FY	MGY blend	Gal B-100
2004	0.345	70,000
2005	0.347	71,000
2006	0.348	71,149
2007 (thru Nov)	nya	336,180**

Climate Change Advisory Committee

Final Report Biodiesel Production Goals

- 2010: 7.4 MGY (2% of 2004)
- 2015: 37 MGY
- 2020: 74 MGY (1.6 M acres/year)

Montana Use & Goals Previous Slide

Biodiesel use has been growing in Montana.

The 70,000 gallons of B100 in state fiscal years 2004 to 2006 represent about 345,000 gallons of blended fuel. The 336,180 gallons in calendar year 2007 (through November) represent about 1,105,820 gallons of blended biodiesel used as B5, B20, B50, and B100.

The Montana Climate Change Committee Final Report set goals of 7.4 million gallons of biodiesel production & use by 2010, and 74 million by 2020.

National Energy Policy Next Slide

The federal energy bill passed in 2007 and signed into law requires 1-billion gallons of biomass-derived diesel to be produced and used by 2012. Estimated production in 2008 is 450 million gallons in 2007 (NBB, January 2008) that closes in on the 500 million (0.5 billion) goal for 2009.

The definition for "biomass derived diesel" is not ASTM 6751, so the goal is a bit confusing.

The National Biodiesel Board has a goal of 1.85 billion gallons produced in 2015

Biodiesel in SFR

Year	Conventional Biofuel	Advanced Biofuel	Cellulosic Biofuel	Biomass-derv. diesel	Total RFS
2008	9	-	-	0.45 ~2007	9
2009	10.5	0.6	-	0.5	11.1
2010	12	0.95	0.1	0.65	12.95
2011	12.6	1.35	0.25	0.8	13.95
2012	13.2	2	0.5	1	15.2
2013	13.8	2.75	1	*>1	16.55
2014	14.4	3.75	1.75	*>1	18.15
2015	15	5.5	3	*>1 (1.5)	20.5
2016	15	7.25	4.25	*>1	22.25
2017	15	9	5.5	*>1	24.
2018	15	11	7	*>1	26
2019	15	13	8.5	*>1	28
2020	15	15	10.5	*>1	30
2021	15	18	13.5	*>1	33
2022	15	21	16	*>1	36

Biodiesel Use in Montana

11 retail/bulk biodiesel distributors

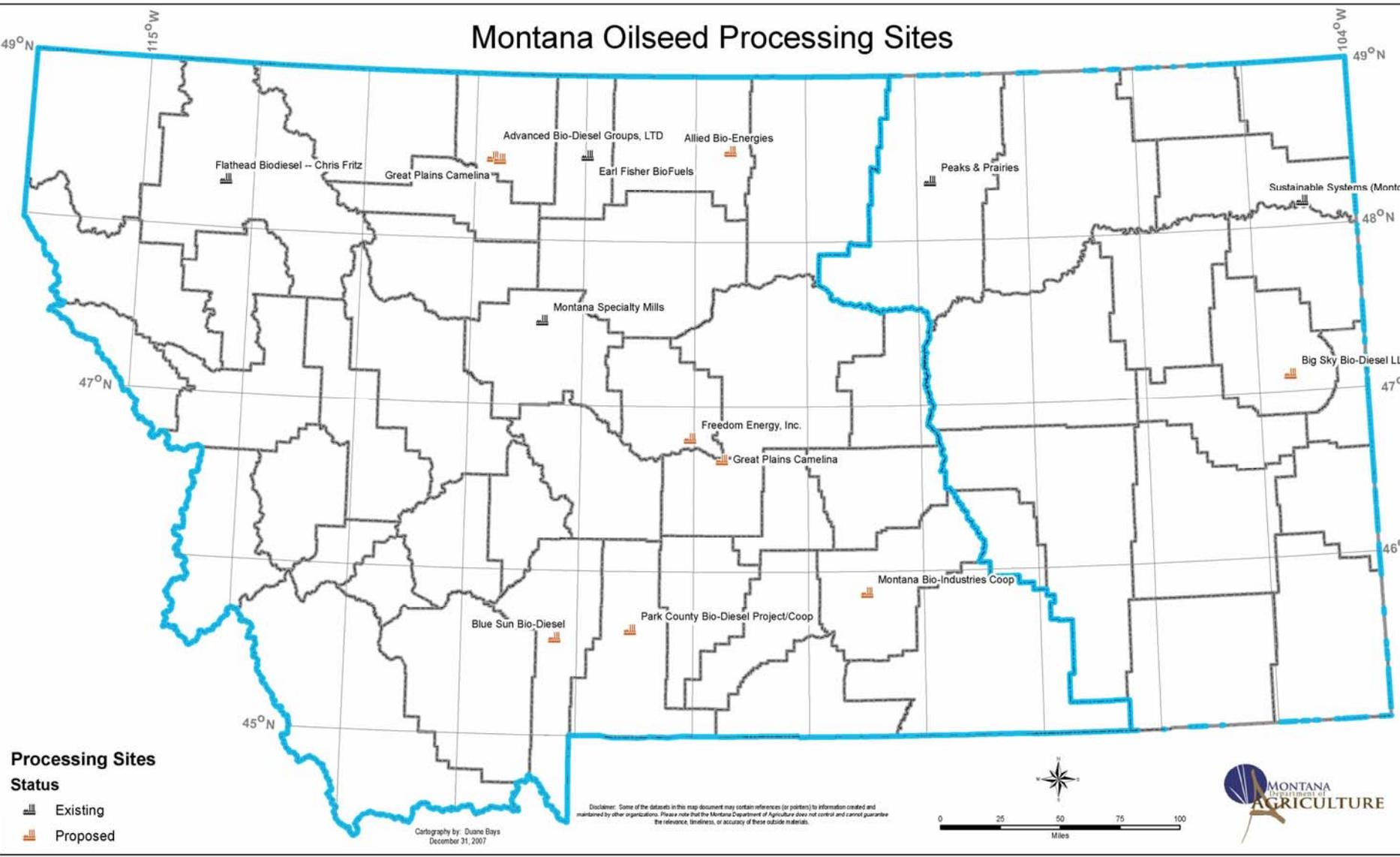
- 70,000 gallons of B100 each year, 2002-06
(345,000 gallons of blend)

- 336,180 gallons (B100) thru Nov 2007

- Fleets: Yellowstone and Glacier National Parks, BLM, City of Bozeman, Stillwater

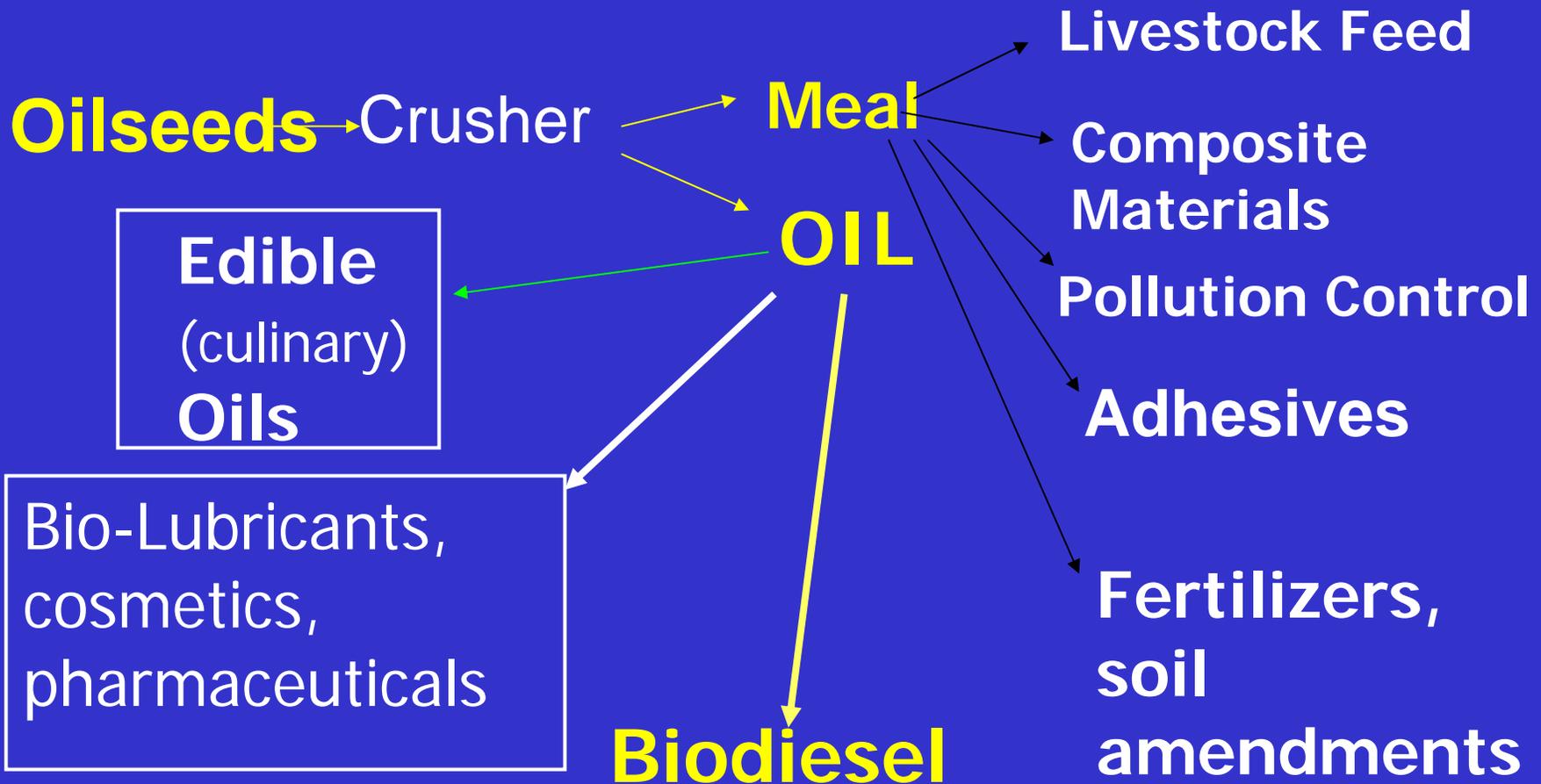


Montana Oilseed Processing Sites



Over 22 commercial or self-use sites as of Oct 2007

Oilseed Value Chain: Biodiesel is the low value product



WHAT: Biodiesel in Montana

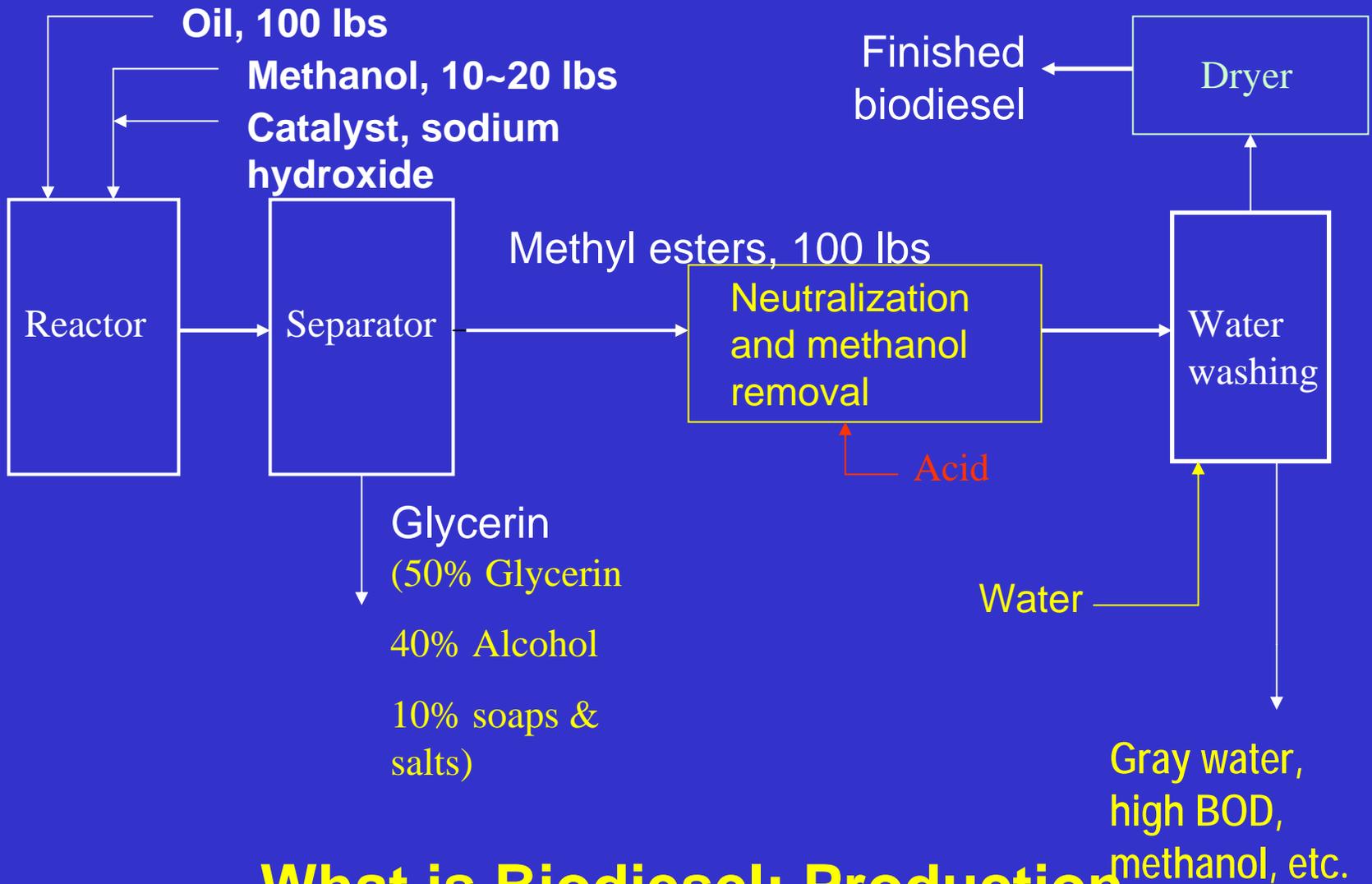


Biodiesel is not new.

Biodiesel is an animal fat or plant oil reacted with an alcohol with a catalyst to make an (monoalkyl) ester (of long-chain fatty acids) used as a fuel blend stock meeting ASTM D6751.



The "B" B20- 20% biodiesel + 80% petroleum



What is Biodiesel

Biodiesel is NOT: Unprocessed vegetable oil, UFO

- Ethanol blended with diesel (E-diesel)
- Fuel derived from gasification/liquefaction of biomass
- Oils/fats with crude oil to petroleum refinery
- Oils/fats through hydrotreater

These do not meet definition (D 6751, mono-alkyl esters of fats and oils) or credentials



UFO is NOT biodiesel Prior Slide

The piston pictured on the previous slide is from a tractor that used unprocessed vegetable oil as a blend fuel for 6-months. The piston had more deposits than expected. The injectors had significant coking deposits.

The fuel filter on the right an engine using 8-percent used fry oil in diesel for 60-days. The good news is that the triglyceride globs did not end up in someone's blood to raise cholesterol--the bad news is that some broke through (the torn filter paper) and formed engine deposits.

What Biodiesel Credentials

These other "renewable diesels"

- **HAVE NOT PASSED EPA Tier I & Tier II Health & Safety requirements of Clean Air Act**
- **Do not have a certificate of conformity from EPA showing they do not impact OEM equipment**
- **Only alternate fuel with its own Quality Assurance Program BQ-9000**



Tier I & II Health
& Safety Data



BIODIESEL BENEFITS

- Safer (higher flash point)
- New market for producers
- Adds lubricity and cetane
- Lower emissions



BIODIESEL BENEFITS

**LOW INITIAL COST-no
modifications (pre-1993)**

**SIMILAR POWER,
VEHICLE RANGE,
Blends in any proportion**

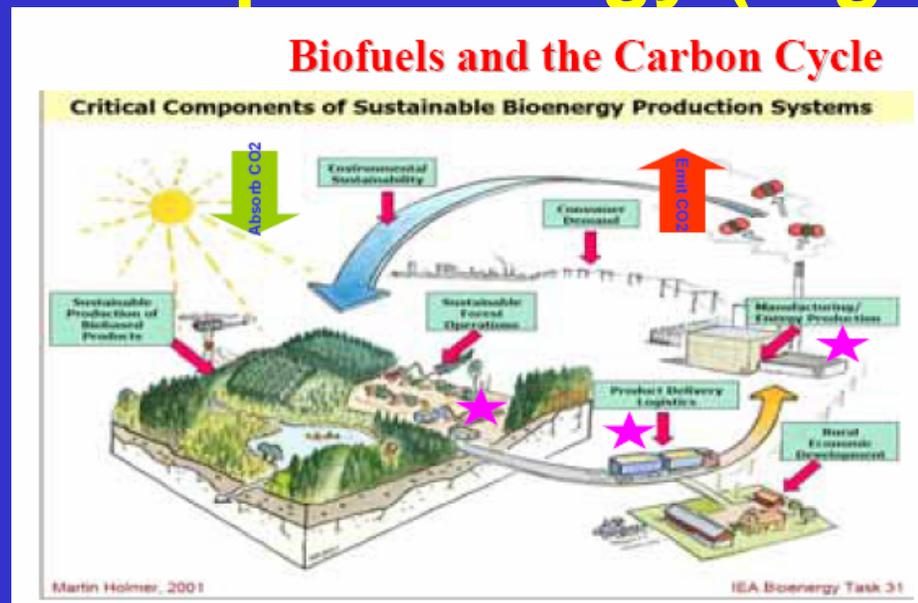


**HIGH BIODEGRADABILITY,
EASIER SPILL CLEAN-UP
FOR B-100**

**REDUCED CO, ODOR,
SOOT**

Biodiesel Benefits: green house gas (GHG) reduction in rural areas.

1. Take up CO₂ when they grow
2. Reduce all 3 GHG emissions when used (CO₂, CH₃, N₂O)
3. Reduce transport energy (regional use)



Offset Rates Computed Through Lifecycle Analysis

Net Carbon Emission Reduction (%)

Ethanol Electricity Biodiesel

Bio feedstock	Ethanol	Electricity	Biodiesel
Corn	43		11
Soybeans			96
Sorghum	45		
Barley	43		
Oats	39		
Rice	12		
Soft White Wheat	42		
Hard Red Winter Wheat	41		
Durham Wheat	39		
Hard Red Spring Wheat	42		
Sugar	28		
Switchgrass	81	87	
Hybrid Poplar	72	89	
Willow	74	94	
Softwood Log Residue	68	91	
Hardwood Log Residue	69	91	
Bagasse	86	95	
Corn Residue	84	91	
Wheat Residue	79	88	
Sorghum Residue	73	76	
Barley Residue	56	64	
Rice Residue	55	62	
Softwood Mill Residue	76	95	
Hardwood Mill Residue	76	95	
Manure		91	

**Biodiesel
compared to diesel**

**Ethanol offsets are in
comparison to
gasoline**

**Ref: Bruce McCarl, Texas
A&M, Feb 2007**

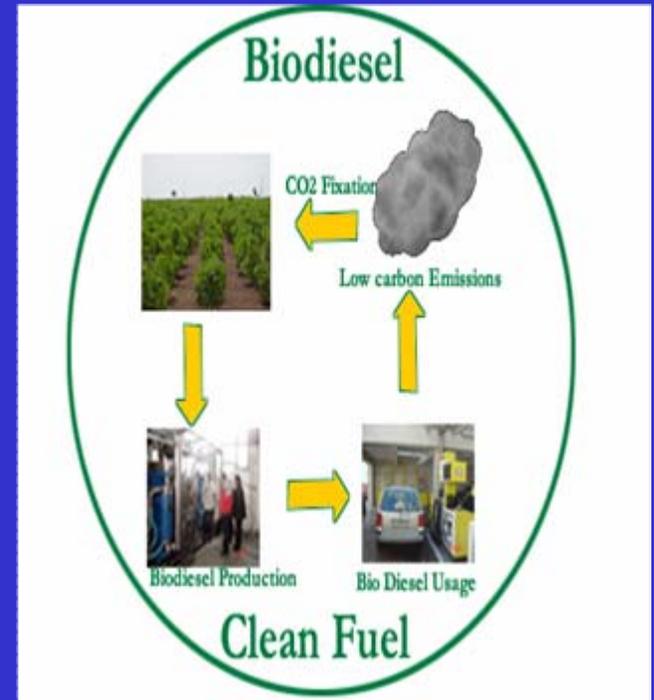
Biodiesel Benefits: Carbon Interaction

- Soybean oil contains 75% carbon by weight
- That carbon came from the plant taking up CO₂ from the atmosphere (Atmospheric N also fixed).
- Convert carbon back to CO₂: every pound of soybean oil contains the equivalent of 2.77 lbs of CO₂ from the atmosphere.

• **Greenhouse Gases – A 78% life cycle decrease in CO₂** (joint

USDA and DOE study, EPA methods).

Estimated to sequester CO₂ at a cost of \$9-14 per ton of CO₂ (ref MT Gov CCAC plan)



Biodiesel Net Energy

- **Energy Balance - every 1 unit of energy to make biodiesel produces 3.2 units of energy.** USDA & DOE "NREL" study, 2006
- **Greater conversion (>3.2) with canola, UI 2007: more oil per acre, fewer inputs**
- **Possibly better with algae**
- **Potential use credits**

Biodiesel Benefits, Net Energy

- Possibly better with algae e.g. about 300 ac~60 mgy biodiesel, + 30 mgy cellulosic ethanol

Emissions-to-Biofuels algae

bioreactor system Redhawk power

plant in Arlington, AZ, 1,040 MW

NG plant (GreenFuel Tech. Cambridge Mass)

Captured 80% of CO₂ upcom.axiion.com



Challenges to Biodiesel

- Cost and availability
- Federal & local regulations (testing, quality)
- Sustainable, reliable oilseed supply--
Montanan needs growers
- Markets for co-products (where's the beef)
- Possible lower cost feedstocks (mustard, camelina)
- Good (short) transportation



Challenges for Biodiesel

Price & Availability

- Cost is feedstock sensitive (75-80%).
- Production cost is generally estimated to be about \$0.55/gallon (small plant) to \$0.30/gallon (large plant).
- Production cost = $7.6 \times [\text{oil price, \$/lb}] + \$0.50$ per gallon. example, canola oil @ \$0.28/lb gives \$2.63/gal before tax

Challenges for Biodiesel

Current federal excise tax credit is \$1.00/gallon for biodiesel from virgin oil

- **With current incentives, biodiesel should be \$1.30-\$1.50/gallon (without road tax). Actual price is set by the market.**

- **Biodiesel is less than diesel in some areas.**



Implications for Biodiesel in Rural Montana

Self-Sufficiency, self-production & use:

Control of operating costs

Uses 8-9,000 gal diesel/year, summer

No additional miles for fuel or to haul crop

Use meal on-site or for local feeding



<\$5,000, produces 40 gal per day, 2~10 hours prep and watching

\$54,000, 40 gal/shift, can de-gum raw oil, reclaims methanol, more automation>



Implications: Things to Know & Be Able to Show

1. Motivation-Why make biodiesel
2. Feedstocks & oil source (buy, UFO, grow)
3. Know and prepare to deal with safety issues and your local rules, and your fire official and insurance requirements
4. Co-products and wastes: Safety.
5. Markets (storage & transport).
6. Know your limits and options: business plan.
7. Know what happens to off-ASTM biodiesel specification fuel and feedstock

Implications for Biodiesel in Rural Montana

1. Built as community scale/regional modules, \$1+ per annual gallon capacity
 - **Chester, 100,000 gal/yr, 10 yrs**



Implications in Rural Montana

1. Basis B2 (2% biodiesel): 9,300,000 gallons/yr.
2. Feedstock: canola ~108,500 tons, 168,000 acres, 40% oil content, 70% recoverable.
3. Invest \$8.5~11,000,000 for a biodiesel plant.
4. Crushing (\$3.5~10.8 million)

Center for Applied Economic Research
Montana State University-Billings

2005 Energy Symposium
October 18th, 2005

www.msubillings.edu/CAER/

The Economic Impact of MT Energy Projects

Implications in Rural Montana, Local/Regional

- 10 ~20 jobs
- 65,000 tons of meal ~\$13,000,000 value
~65,700 dairy cows
- 6,250,000 lbs of glycerin ~ \$312,000 as fuel**
- \$2 ~4.6 million in operating costs, supplies
- \$15.8 million in "Multiplier Value"
- \$1.8 in other (transportation) costs
- \$19.5 million for oilseed (value, \$180/ton)

FOR MORE INFORMATION

- Oilseeds for Fuel, Feed & Future
Al Kurki, ALK@NCAT.org, 406 449 0104
- Biodiesel Tech Course. Jon Van Gerpen, 208 885-7891, jonvg@uidaho.edu
- Safflower, Sunflower, Flax: Jerry Bergman, jbergman@sidney.ars.usda.gov 406 433 2208
- Canola, Camelina: Alice Pilgeram, pilgeram@montana.edu, 406 994 1986
- Taxes: Vanessa Olsen, MDT, volson@mt.gov, 406 444 7276
- Used Fry Oil: (currently vacant) 406 444 9879



Upcoming Events

1. Upcoming workshops:

- National Biodiesel Conference, Feb 3-6, 2008
- Biodiesel Technology Course, March 11-14 2007 in Moscow, Idaho
- **Up to YOU**--fill out the final survey.

2. Montana Agro-Energy Initiative: Biodiesel for the Future (Workshops for schools, pilot demonstrations, training, co-product non-food non-feed training & certifications) <http://dli.mt.gov/WIRED/>

MONTANA'S
agro-energy
PLAN

sponsored by USDOL ETA



This Workshop

- Oilseeds for this area
- Crushing Considerations, Small scale economics
- Use, Quality,
- Feeding oilseed press cake
- Commercial Production & Basic Economics
- Self Use
- Evaluation Survey
- Tomorrow: Business Models, Regulations, Assistance, Site tour



FOR MORE INFORMATION

www.deq.mt.gov, select “bioenergy/biodiesel”

www.biodieseleducation.org

www.biodiesel.org

<http://dli.mt.gov/WIRED/>

Energy & Pollution Prevention 406 841-5200 hhaines@mt.gov





**The End. Thanks for
Listening, Questions?**