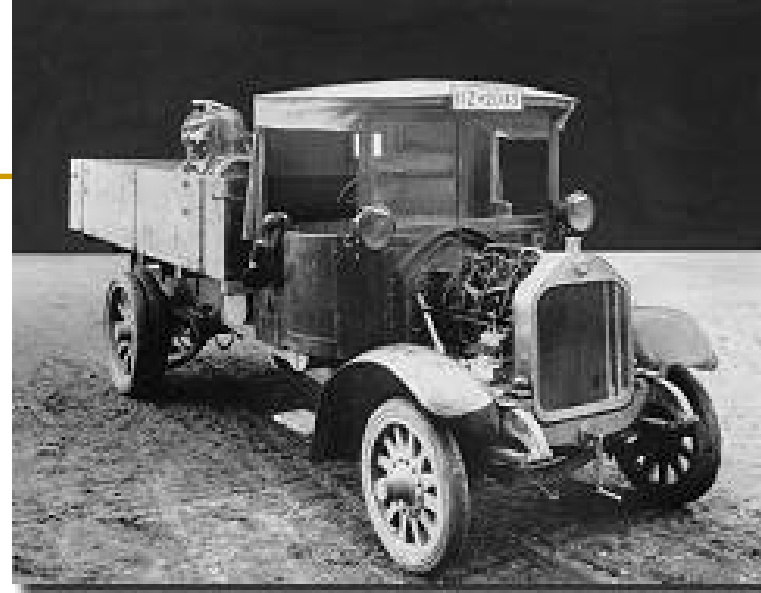


RUBI

Rice University Biodiesel Initiative



Guyton Durnin
Rice University, Houston TX
9/25/2006

Outline for RUBI

1

2

3

4

1

What is Biodiesel?

2

Why Biodiesel?

3

Biodiesel at Rice

4

What Next?

Outline for RUBI

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Biodiesel: the Molecule

Chemical name: Fatty Acid Methyl Esters

Formula: C14-C24 Methyl Esters

Designated Alternative Fuel by USDOE

Registered as a fuel & fuel additive with
USEPA

Specification set by ASTM 6751



What is Biodiesel?

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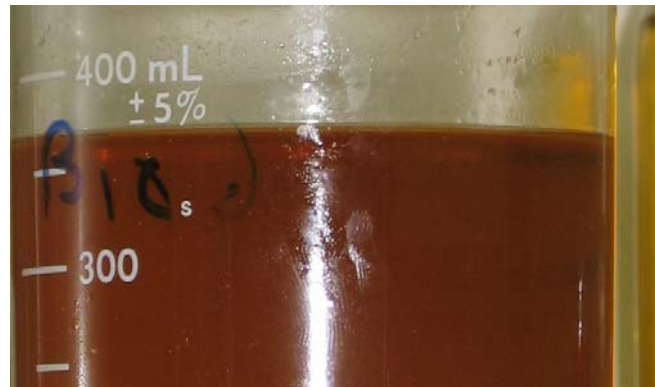
4

Biodiesel looks like the Feedstock

Oil



Biodiesel



Soap Crude/
Crude Glycerol



What is Biodiesel?

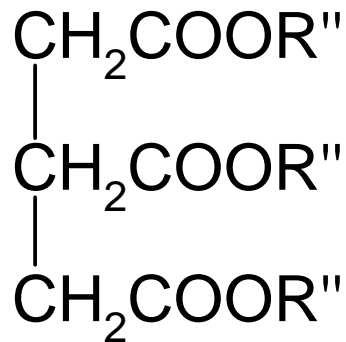
1

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Transesterification



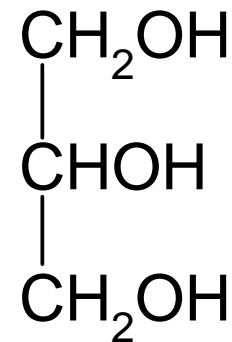
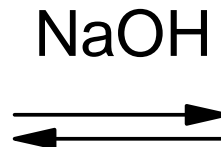
Vegetable Oil
(Triglyceride)

100 lbs



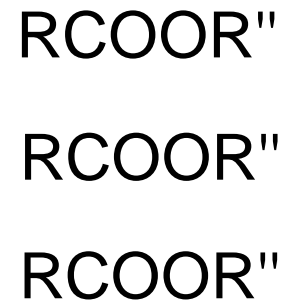
Alcohol

10 lbs



Glycerol

10 lbs



Alykl Ester
(Biodiesel)

100 lbs

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We need Clean Domestic Production
with Smaller Price Swings!



<http://jamescullin.com/p/photoblog/soybean-field.jpg>

Why Biodiesel?

1

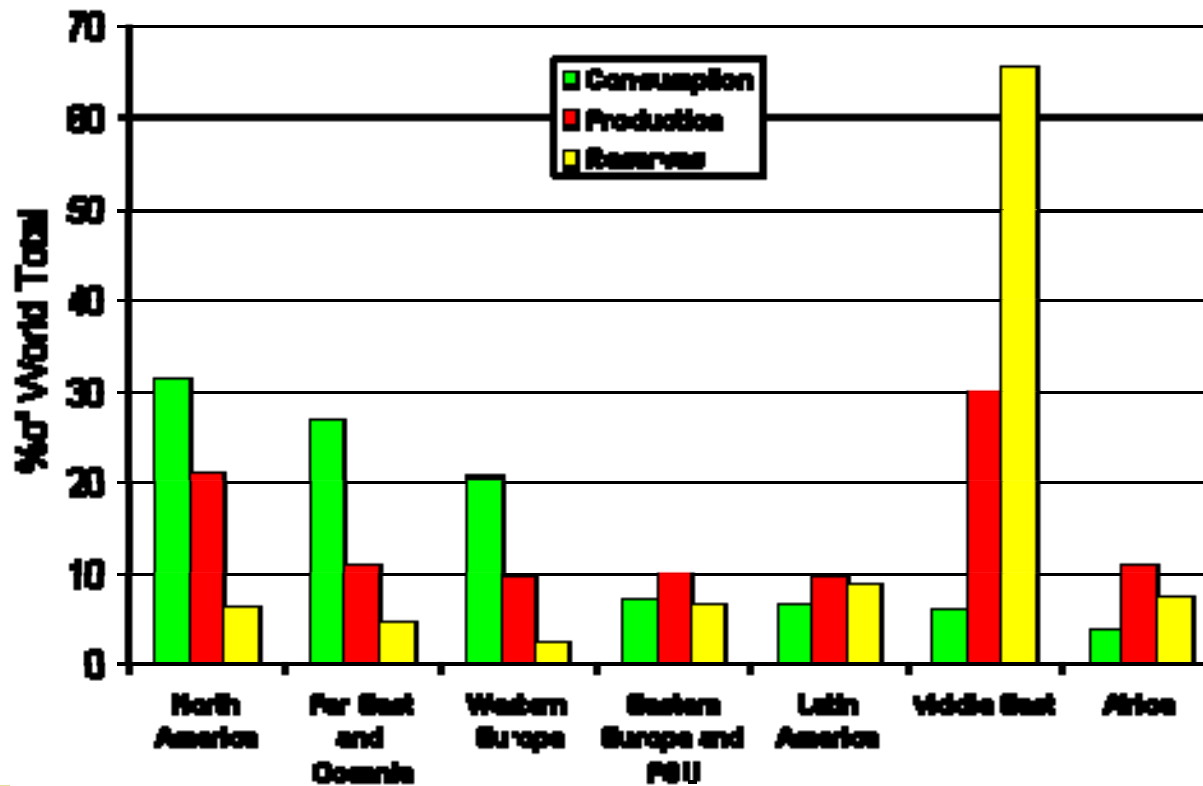
2

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Oil Production and Consumption

**Global Consumption and Production (as at end 1998)
and Reserves (end 1999)**



Why Biodiesel?

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Where Will Prices Go Next?



<http://futures.tradingcharts.com/chart/CO/W?1158063219>

Why Biodiesel?

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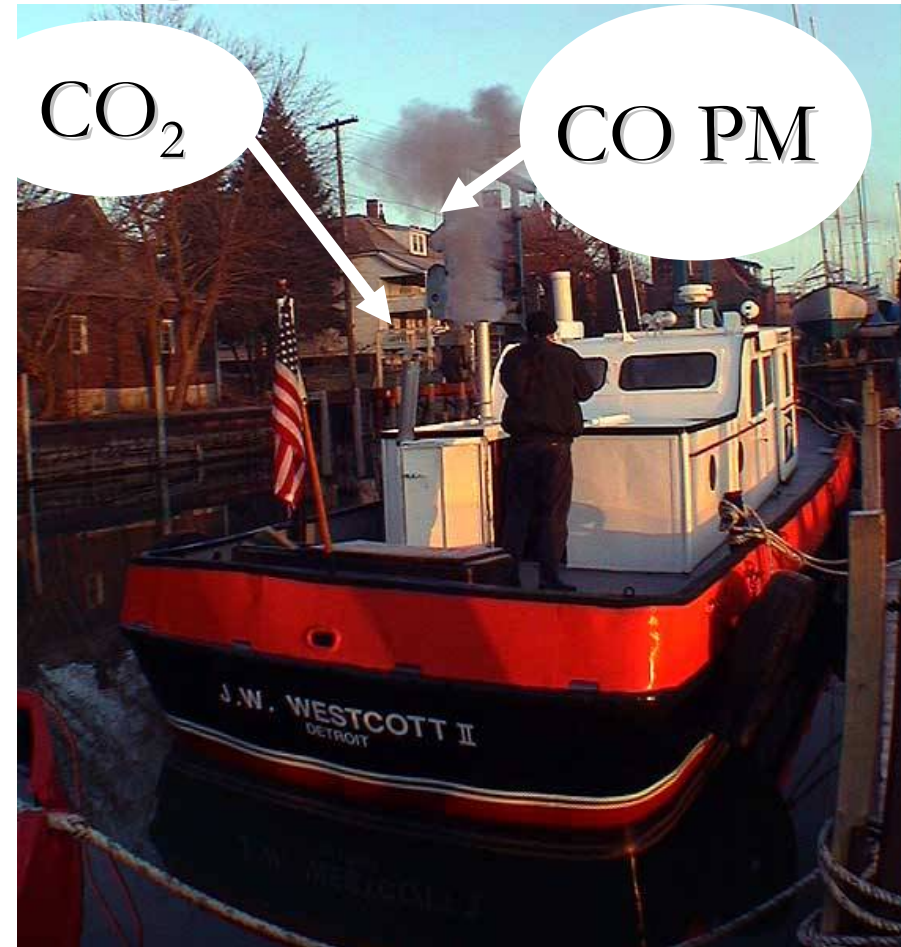
3

4

How Clean is YOUR Diesel Engine Exhaust?

Do You Want to
Breathe Behind this
Boat?

How Hot Do You
Want to Get?



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Biodiesel at Rice

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4

Why?

Oil going to Waste



Large Diesel Expenses



Biodiesel at Rice

1

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Formation of RUBI

Started by Matt Yarrison,
Christine Robichaud,
Christina Eddleman, Lizzi
Clark and Guyton Durnin
Summer 2005

RUBI May 2006



Biodiesel at Rice

1

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2005-2006 RUBI

Lizzi Clark with 200
mL reaction



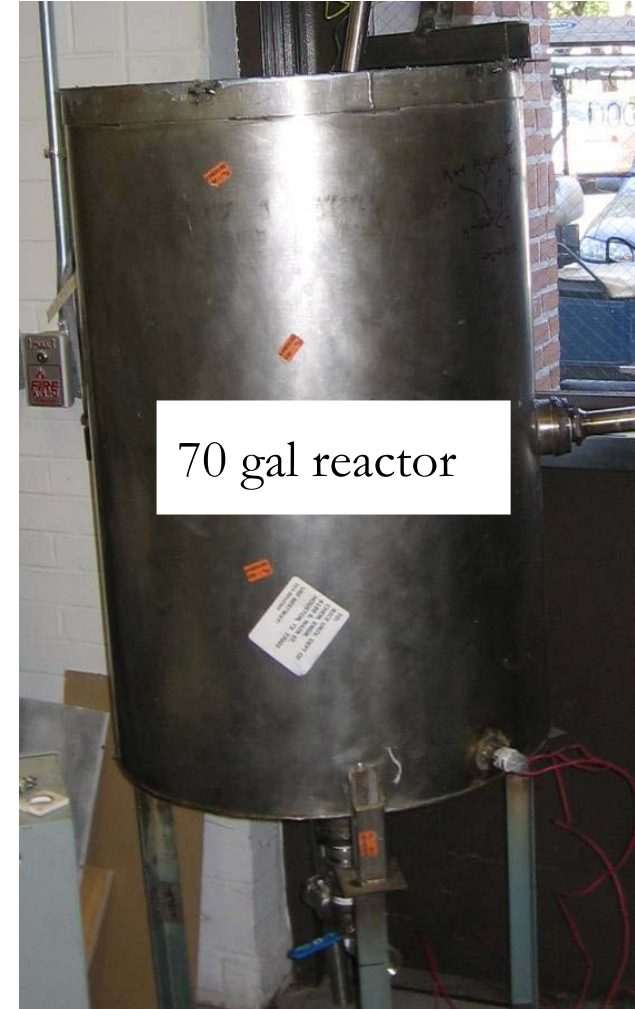
1 gal reactor



1 L



70 gal reactor



Biodiesel at Rice

RUBI Pilot Plant

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Millions of lbs of Glycerol BUT: no Market!

For every 100 lbs of biodiesel, 10
lbs of glycerol are produced

Glycerol prices have fallen from
\$0.15/lb to \$0.02/lb and lower

The US biodiesel industry is rapidly
expanding

Glycerol needs new markets!

Fermentation? Find out tomorrow!



What Next?

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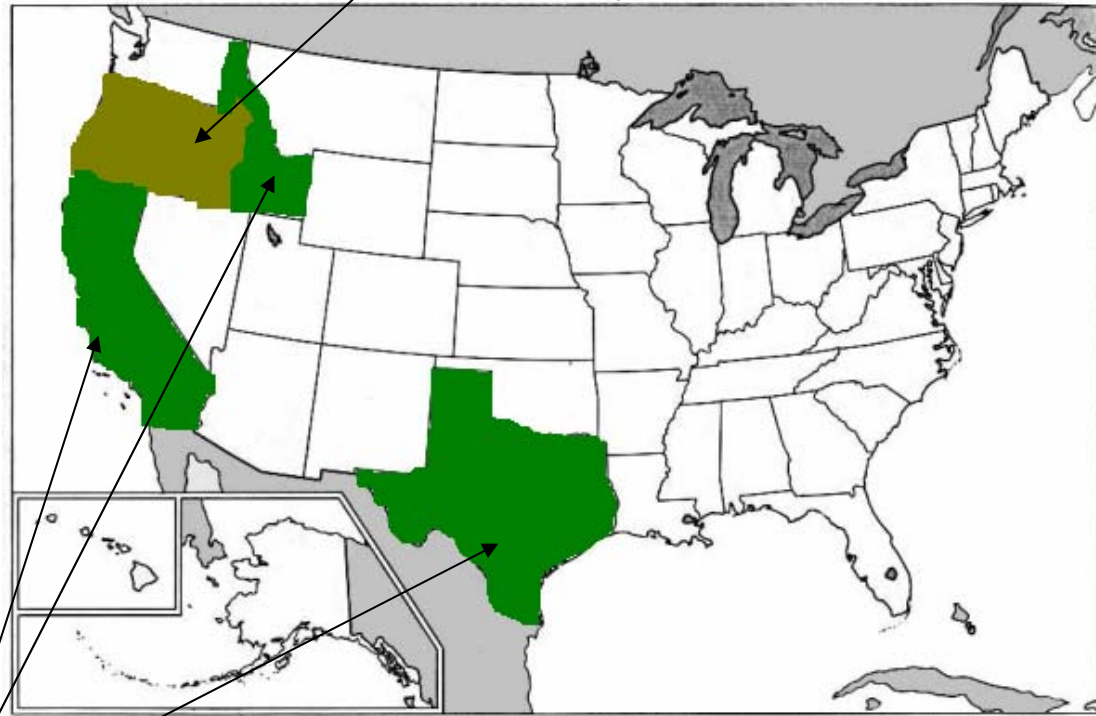
What can Soy do?

30 BGY diesel
consumed in US

23 BGY possible with
soybeans grown on
all US agriculture
land (60 gal/acre)

This is not the cure-all.

Current soybean production



Current agriculture production

<http://www.humanities.uci.edu/users/vfolkenflik/VRF%20Sources/USA%20outline%20map%20Perry%20Castaneda.jpg>

What Next?

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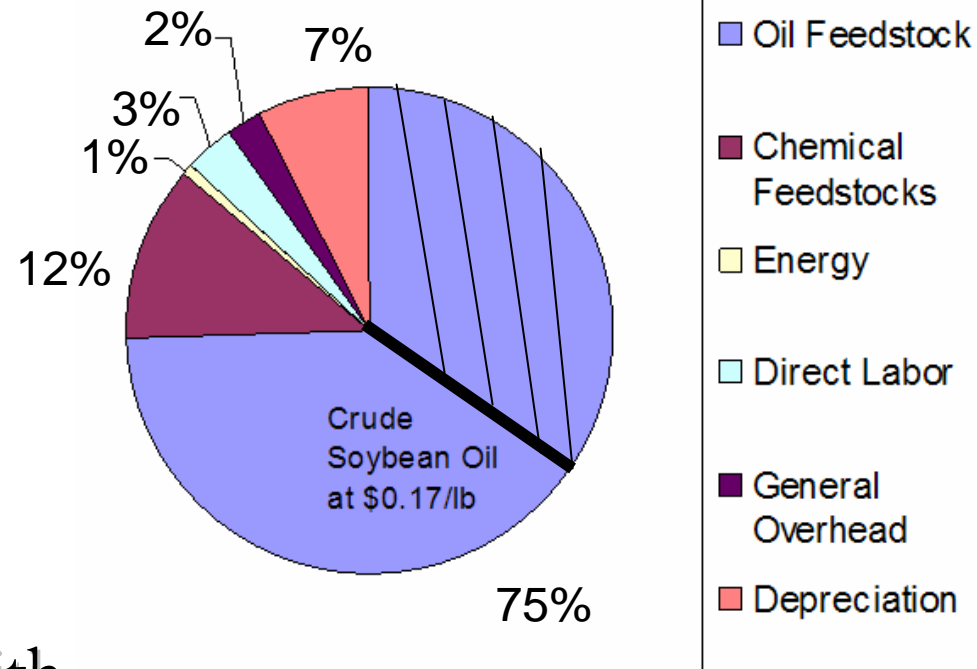
4

What about Waste Grease?

300 MGY from used oil

\$250 MM to \$1 B year
industry in used oil

The economics are better with
a feedstock at $\frac{1}{2}$ the price



What Next?

1

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A reactor in every Neighborhood?

Small reactor facilities

Relatively simple technology

This “plant” could produce
100,000+ gallons/yr



Acknowledgements

RUBI Sponsors:

- Shell Center for Sustainability
- Center for the Study of Environment and Society (CSES)
- Leadership Rice (Envision Grant)
- Department of Chemical and Biomolecular Engineering (ChBE)
- Department of Civil and Environmental Engineering (CEVE)

•Faculty

- Dr. Kyriacos Zygourakis (ChBE)
- Dr. Pedro Alvarez (CEVE)
- Dr. Ramon Gonzalez (ChBE)
- Dick Chronister (ChBE)
- Bob Dawson (CEVE)



Matt Yarrison filling Rice Mower with biodiesel, May 2006

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