Feasibility of On-Farm or Small Scale Oilseed Processing and Biodiesel Production

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Background

- Ethanol boom has benefited corn producers and grainbelt landowners
- Many producers outside the “ethanol belt” are interested in participating in the biofuel economy
- This interest in value-added has spurred interest in small scale oilseed processing and biodiesel production

Why Biodiesel?

- Can be produced from a wide variety of feedstocks
- Farm diesel prices have increased over 300% since the mid 1990's and 100% in the last three years
- Fuel prices are only 10% of the production cost of most crops but are a visible component
- Several states have specific incentives for on-farm biofuel production

On-farm Oilseed Processing

- Crushing and biodiesel production are not technically complex and can be conducted at a farm scale level
- On-farm production eliminates marketing costs and issues with low local basis
- Transportation and retail margins are avoided for both crop and fuel
- Can these factors offset the economies of scale in processing??

Two Examples

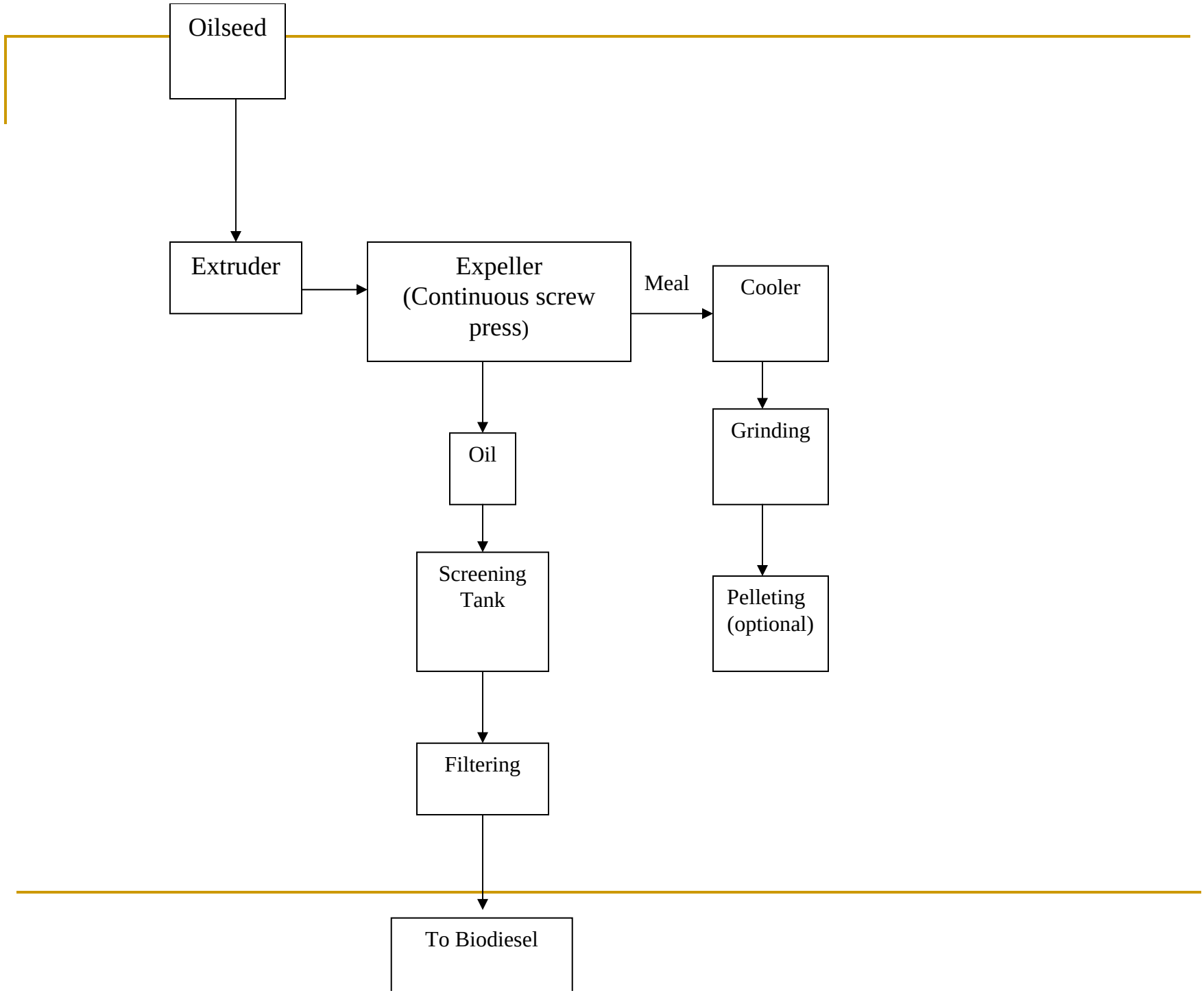
- Baseline feasibility of 250,000 gallon/year plant based on the OSU Oilseed Crushing/Biodiesel Feasibility Template
- Results from on-farm demonstration project of 10,000 gallon year system.

Small Scale Oilseed Processing and Biodiesel Production

- Mechanical extraction technologies included cold press, steam pre-treated expeller and extruder-expeller.
- Heat increases extraction efficiency and can improve the protein and texture of the meal
- Extruder-expeller systems use friction to increase temperature to 135^{o}C

Extruder Expeller

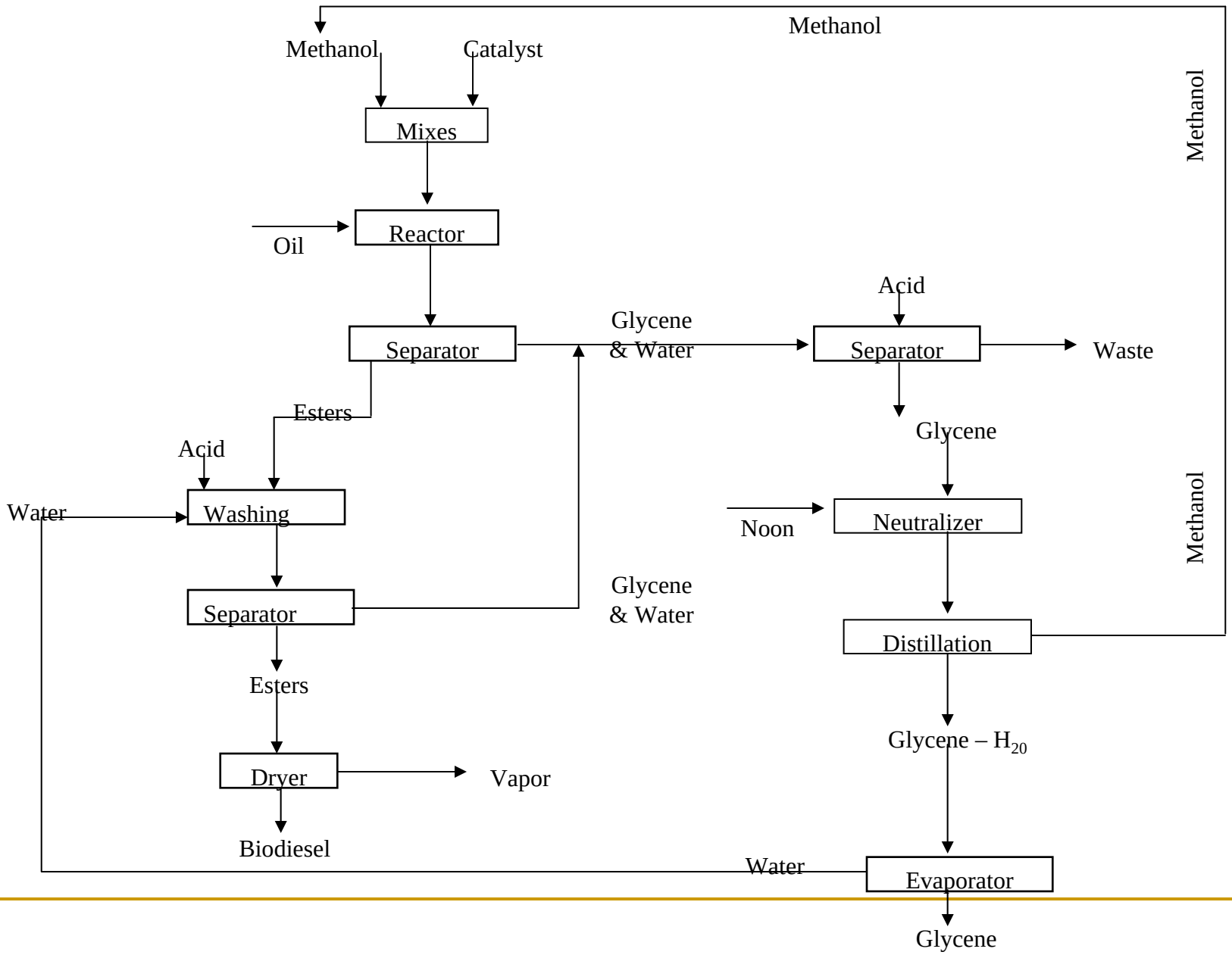
- After leaving the extruder the oil is immediately removed with a screw press
- Short dwell time improves the digestibility and quality of the meal and improves by-pass protein


Oilseed
Extruder
Expeller (Continuous screw press)
Meal
Cooler
Grinding
Pelleting (optional)
Oil
Screening Tank
Filtering
To Biodiesel

Biodiesel

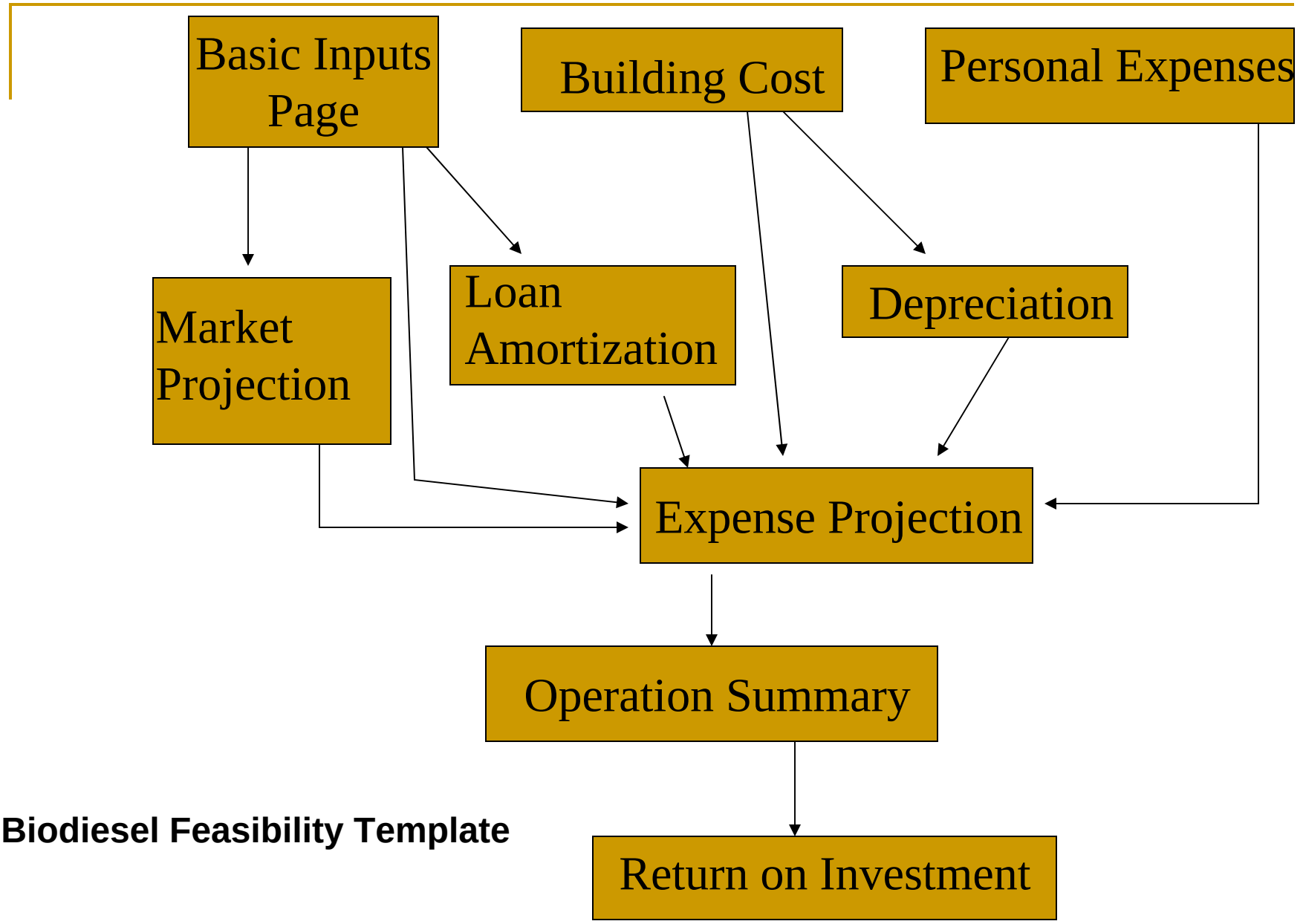
- The most common production process for biodiesel is base catalyzed transesterification
- Methanol or ethanol with potassium hydroxide or sodium hydroxide yields biodiesel and crude glycerol

Biodiesel Production



OSU Oilseed Processing and Biodiesel Production Feasibility Template

- Crushing only or crushing/biodiesel
- Up to three oilseed crops
- Baseline assumptions can be modified by the user
- Sensitivity analysis



Biodiesel Feasibility Template

Baseline Assumptions Small Scale Oilseed Processing and Biodiesel Producton	
Crushing Capacity	1/ton hour or 2,000 ton/Year
Biodiesel Production	250,000 gallons
Equipment Costs	$342,000
Capital structure	50% debt- 7.5%
Canola price	$.11
Sunflower price	$.15
Soybean price	$8.00

Baseline Assumptions Small Scale Oilseed Processing and Biodiesel Producton	
Extraction Efficiency	80%
Biodiesel Price/gallon	$3.00
Meal Value/ton	$300
Oklahoma tax credits	$.20/gallon
Payroll and benefits/year	$182,000
Utilities/year	$195,000
Repairs, Maintenance and Insurance/year	$23,000

Table 1: Sensitivity of Canola Processing Return to Biodiesel Value						
Biodiesel Price	$2.90	$3.00	$3.10	$3.20	$3.30	$3.40
Internal Rate of Return	Negative	**5.7%**	15.7%	24.2%	40.2%	47.9%
Return on Assets	-3.3%	4.4%	12.1%	19.7%	27.4%	35.0%
Return on Equity	-6.4%	8.8%	24.2%	39.5%	54.8%	70.0%

Table 2: Sensitivity of Canola Processing Return to Meal Value

Meal Price	$280	$290	$300	$310	$320	$330
Internal Rate of Return	Negative	.3%	5.7%	10.7%	15.3%	19.6%
Return on Assets	-3.1%	.7%	4.4%	8.1%	11.9%	15.7%
Return on Equity	-6.2%	1.3%	8.8%	16.3%	23.8%	31.3%

Table 3: Breakeven Oilseed Crop Values at Various Biodiesel Prices

Biodiesel Price	$2.50	$2.75	$3.00	$3.25	$3.5
Breakeven Canola Price $/lb.	$.082	$.097	$.113	$.130	$.146
Breakeven Sunflower Price $/lb	$.074	$.091	$.108	$.125	$.143
Breakeven Soybean Price $/bu.	$5.3	$6.00	$6.70	$7.40	$8.10

Oklahoma On-Farm Example

- 70 acres of sunflowers
- 1,600 lb acre
- 3.55 gallons/cwt – 67% extraction efficiency
- $8,212 equipment cost
- 280 lbs or .14/tons per hour
- $3.00 value for biodiesel
- $100/ton value for meal
- $1.20/gallon tax credits

Oklahoma On-Farm Example

- $.11 sunflower value
- $.094/lb production cost
- 67% extraction efficiency
- 2,200 gallons of biodiesel produced
- 225 hours of operation
- $8.50 hour labor

Cost Comparison: Small Scale Base-line with On-Farm Case Study		
	Baseline	On-farm
Sales (biodiesel, meal, tax credits)	$4.66	$4.54
Oilseed	$2.52	$2.58
Utilities	$.78	$.08
Methanol	$.01	$1.12
Labor	$.66	$.85
Depreciation	$.12	$.55
Interest	$.04	$.11
Net Income before taxes	$.18	($1.38)

Conclusions

- Small scale crushing/biodiesel is marginally feasible. On-farm scale is not feasible at current prices
- Returns are sensitive to the farm level value (price) of biodiesel, meal value and value placed on crop
- On-farm processing of high oil content crops such as canola or sunflowers are marginally feasible
- At current soybean prices, feasibility of on-farm processing of soybeans would require biodiesel value above $5/gallon and meal value remaining at historically high levels