Economic Impact of Soy Diesel in Kentucky

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"Statistics show that if the country used a 1 percent blend of soybean diesel with on road diesel fuel, it would eliminate 250 million bushels of soybeans --- the carryover number from last year. Furthermore, at that rate, some 300 million gallons of bio-diesel would be needed and would, according to USDA (United States Department of Agriculture), add a minimum of 35 cents per bushel to soybean prices."

As a former USDA-ERS (Economic Research Service) economist that has also worked as a voting member of the World Agricultural Outlook Board and who helped generate USDA 15 year baseline projections, I often find USDA forecasts a little optimistic. However, there is reason for optimism concerning the effects renewable fuels will have on the environment and farm community.

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I. Executive Summary

A 5 percent blend of soybean oil to petroleum would use 24.3 million bushels of soybeans and increase the output impact of Kentucky's soybean crop by $160 million. Bean processing would rise by 158 percent over current levels with soybean oil production adding $50 million dollars and soybean meal another $151 million.

These revenue increases would resound through the Kentucky economy as the income effects were multiplied by purchases of other goods and services. All things considered, another $571 million would be added to the Kentucky economy and 3020 new jobs would be created. Total tax revenue would increase by $68.5 million. These projections will change as we change the amount of soybean oil in the blend. If a 1 percent blend is used, the effects will be smaller. If a 20 percent blend is used, the effects will be larger. In fact, a 20 percent blend would have a total output impact of $2.16 billion and tax revenue conservatively estimated at $245 million.

Non-economic benefits would occur as well. A B20 bio-diesel blend (20 percent soybean, 80 percent petroleum) would reduce carbon monoxide by 13 percent, hydrocarbons by 11 percent, air toxic particulates by 18 percent and reduce the cancer risk from diesel by 27 percent. Early research determined that more smog would result from bio-diesel because more nitrogen oxide would be released. However, more recent research has indicated that when pure diesel is used, the nitrogen oxides produced amount to either a slight increase or a slight decrease compared when those produced when conventional diesel fuel is used[1]. Nitrogen oxide emissions are virtually unaffected when a B20 blend is used. In addition, bio-diesel use diminishes other pollutants to the extent that overall ozone potential decreases by 50 percent.

Bio-diesel is cost effective. University of Minnesota economist Douglas Tiffany has estimated that 2 percent bio-diesel blend will increase retail pump costs only six-tenths of a cent. Consumers would benefit from lower federal taxes, increased state tax revenues, economic expansion and the aforementioned environmental improvement.

John Deere, Caterpillar, Detroit Diesel, International and Cummins have approved bio-diesel use in their heavy-duty engines. Use of bio-diesel will not void their warranties. Many schools and public transportation systems in Kentucky are also presently using bio-diesel in their bus and van fleets[2]. The increased lubricity of bio-diesel fuel helps to reduce engine wear.

The primary impetus for economic expansion will occur as a result of being an early entrant into soy diesel processing industry. If Kentucky is a late entrant state, economic profits will be earned by other states as a result. The economic benefits occurring from bio-diesel will be greatly diminished for laggards.

[1] Climate Solutions Special Report and Bio-diesel Fuel: Clean Burning and Cost Effective Alternative to Diesel, Connecticut State Representatives Piscopo and Miller, www.burlingtongop.org.
[2] Murray State University is also using bio-diesel.

II. Effects of Using Various Soy Diesel Blend Ratios on the Environment

According to the National Biodiesel Board a 5 percent bio-diesel blend used in Kentucky would "reduce poisonous carbon monoxide emissions by more than 3 million pounds; reduce hydrocarbon emissions by about 340 thousand pounds, reduce hazardous diesel particulate emissions by 256 thousand pounds and reduce acid rain causing sulfur dioxide emissions by about 265 thousand pounds." It would also "reduce harmful and cancerous polycyclic organic matter impact to streams, wildlife and humans by more than 80 percent."

The environmental benefits that would accrue from using higher levels of soybean oil in bio-diesel blends arise primarily in the reduction of air toxics that include particulates and carbon emissions including carbon monoxide, carbon dioxide and hydrocarbons. According to the U.S. Environmental Protection Administration, toxic particulates are sub-micron sized toxins that pass through the lungs directly into the blood stream. These toxins have been determined to cause cancer and exacerbate other types of respiratory ailments.

Another toxic particulate, the acid rain causing pollutant sulfur dioxide, contributes the familiar diesel odor and causes the burning sensations common to the eyes, lungs and throat[3]. Carbon dioxide, the primary contributor to global warming, and subsequent effects is greatly reduced when using bio-diesel. According to Green Trust, the use of bio-diesel decreases the solid carbon fraction of particulate matter and eliminates the sulfate fraction (B100 diesel emissions smell like popcorn). Bio-diesel also works with new technologies including catalysts (that reduce hydrocarbons), particulate traps, and exhaust gas recirculation. The total speciated hydrocarbon mass is half that for diesel fuel. Bio-diesel use also reduces formaldehyde and acetaldehyde by as much as 30 percent.

Early research determined that more smog would result from bio-diesel because more nitrogen oxide would be released. However, more recent research has indicated that when pure diesel is used, the nitrogen oxides produced amount to either a slight increase or a slight decrease compared when those produced when conventional diesel fuel is used. Nitrogen oxide emissions are virtually unaffected when a B20 blend is used. In addition, bio-diesel use diminishes other pollutants to the extent that overall ozone potential decreases by 50 percent.

[3] As federal regulations go into effect mandating the reduction of sulfur emissions, petroleum lubricity will be reduced and engine wear will increase. Bio-fuels will remedy this problem.

Table 1. Toxin Reductions from High Levels of Soybean Oil Mixes

Environmental Impact	B100	B20
Air Toxics	-60%-90%	-12%-20%
Particulates	-55%	-18%
Carbon Monoxide	-43%	-13%
Hydrocarbons	-56%	-11%
Cancer Risk	-94%	-27%
Ozone Potential	-50%	-10%

Sources: U.S. Environmental Protection Administration, U.S. Department of Energy

III. Effects of Using Various Soy Diesel Blend Ratios on US Farm Sector and Economy

If a 1 percent blend of renewable sources of fuel sources were used in place of a 100 percent petroleum fuel, soybean prices and farm incomes would increase while government payments for agriculture programs would decrease significantly. This environmentally and economically sound policy would encourage farmers to increase soybean production, reduce carryover, increase producer level soybean prices, increase farm incomes and reduce government program payments. At the same time, the US economy would be less dependent on supplies of foreign crude oil. In 2000, imports accounted for approximately 60 percent of US crude oil requirements. The Energy Information Agency estimates that we will import almost 70 percent of our crude oil requirements by 2015.

Approximately 35 million gallons of bio-diesel fuel were manufactured in the US in 2001 with almost that entire amount generated from soybean oil. Bio-diesel use will increase to 250 million gallons by 2015 with a 1 percent bio-diesel blend. The amount of soybeans necessary to increase soy diesel manufacturing to this level would rise from 55 million additional bushels in 2003 to 140 million bushels in 2015. A 5 percent soy blend would require another 260 million bushels while an environmentally preferable blend of 20 percent soy to diesel ratio would require another 700 million bushels. Additional land will come into soybean production primarily from land competing crops such as corn and wheat in the north and corn and cotton in the south, although demand for corn for ethanol could significantly increase the acreage planted to corn as well. As anticipated demand for bio-diesel increases at increasing rates from 2000-2015, the number of acres planted in soybeans could increase by more than 3.4 million acres, while a 5 percent blend would increase plantings by nearly 10 million and a 20 percent blend by nearly 27 million acres (though not all in the United States).

At a 1 percent soy diesel ratio, the amount of soy oil needed will increase dramatically with more than 2 billion pounds required over the 2000-2015 baseline period[4] with the preponderance of the demand increase occurring over the final five years. Soybean crush will increase consistently over the USDA baseline period (at least 150 million bushels with a 1 percent ratio, substantially more with a 5 percent blend or a 20 percent blend).

As a result of the increased demand for soybeans arising from a 1 percent bio-diesel ratio, crude soybean oil prices are expected to rise by an average of 4 percent over the period. Since soybean meal is a complement to soy oil, increased demand for (and subsequent increased production of) soy oil will result in an increased supply of soy meal. As a result, soy meal prices will increase slowly in real terms with a 1 percent soy diesel blend ratio; experience a marginal decline in real value with a 5 percent bio-diesel blend and a larger decline with the 20 percent blend.

[4] The USDA baseline is the forecast made by USDA officials in the absence of renewable fuels. The manner in which it is performed will remind some people of bologna production.

The best predictor of prices in the very near term for almost all commodities, and certainly soybeans, is the USDA stocks to use ratio. In essence, the stocks to use ratio is a pressure gauge with price reflecting the relative price pressure on (i.e. relative scarcity of) the commodity. Given the size of the expected increase in demand and the aforementioned increases in acreage devoted to soybeans, soybean prices would increase markedly. A 1 percent bio-diesel could be expected to increase soybean prices by 25 cents per bushel over their price without a bio-diesel use. A 5 percent requirement for bio-diesel could increase soybean prices by more than one dollar per bushel while a 20 percent requirement would likely increase prices by nearly $2.10 per bushel. As soybean prices increase, more competition will come from other oilseeds, other vegetable oils and recycled vegetable oils and animal fat sources. This competition will reduce the rate of increase in soybean prices as the proportion of non-petroleum fuel to petroleum fuels increases. Consequently, it would be a mistake to assume a linear increase in soybean prices as non-petroleum requirements are increased.

Forecasts by AUS business consultants[5], that focused primarily on corn production and consumption while including a sliding scale increase in soy diesel from 1 to 4 percent over the USDA baseline period of 2001-2016, maintain that consumer food prices will not rise significantly in response to increase demand for renewable fuels. Indeed, food prices are more significantly impacted by labor, packaging and transportation costs than by the prices of agricultural commodities. The greatest effect on food prices from increasing the amounts of renewable sources used in fuels will occur in the livestock industry. Even here, AUS consultants believe "Increased supplies and lower prices of DDG corn gluten and gluten meal, and soybean meal will offset higher corn prices. Consequently, beef production is projected to decline 0.6 percent compared to USDA baseline levels between 2002 and 2016. Pork production is projected to fall 3.1 percent and broiler output by 1.9 percent versus a market without renewable fuel use." Since livestock production is expected to fall vis-à-vis production levels without renewable fuels, we can expect prices to rise. Price increases in the cattle market due to increases in grain prices will likely be dominated by health information concerning red meat consumption whether they are positive or negative. Cattle prices have become increasingly demand driven in recent history. There is a higher probability that grain prices will have a demonstrable effect on pork and chicken prices since these food sources have fewer substitute feeds available. However, the expected price increase of each will likely be within the bounds of USDA baseline estimates.

Both farmers and taxpayers, so often at odds in recent history, would both benefit from requiring renewable energy sources in road diesel products. AUS estimates that farm income could increase "by nearly $100 billion by 2016", $6.6 billion of which would be net. While AUS estimates include ethanol requirements in addition to soy diesel, a significant portion of the proceeds would accrue to soybean producers. Taxpayers would benefit because grain prices would undoubtedly increase above loan rates. In addition, 5 percent soy-diesel blends and 20 percent bio-diesel blends would likely eliminate the need for any government cash payments.

[5] AUS Inc., Moorestown, New Jersey, (AUSInc.com).

IV. Economic Impact of Soy Diesel in Kentucky

A. Kentucky's Soybean Industry

1. Soybean Production

- Kentucky is the 14th largest soybean producer in the United States contributing nearly 2 percent of the United States total soybean production.
- Soybeans are a major crop in Kentucky generating $223 million in cash receipts or 13 percent of Kentucky's total crop value.
- In 2000, Kentucky produced a record high 46 million bushels of soybeans from 1.18 million acres.
- The 2000 crop also produced the highest yields on record: 39 bushels per acre.
- From 1988 to 2000, the annual rate of increase in production has been 5.5 percent.

2. Soybean Processing

- Kentucky produces many more soybeans than it processes in the state.
- Owensboro Grain, in Owensboro, Kentucky is the only soybean processing facility in the state.
- Kentucky exports about 70 percent of the soybeans it produces to foreign nations or to other states for processing while in state processing accounts for only 30 percent of the total.
- Kentucky loses the income and tax revenue that could be earned if the beans produced within its borders were transformed into higher priced value added products. Instead, Kentucky is a supplier of bulk agricultural products for more highly developed economies.
- The greatest economic benefits from agriculture, in terms of income, employment and funding for government services lie in value added products.
- The market for soy diesel is in its infancy. Early entrants into this market will reap the greatest gains.

3. Soybean Exports

- Soybeans are the third largest export commodity for Kentucky agriculture with an estimated export value of $85.9 million in 1999, more than 9 percent of the state's total agricultural exports.

- Kentucky exports more of its soybeans than most other states.

4. Soybean Prices

- Grower prices for soybeans in Kentucky averaged $6.14 per bushel since 1980 with a high of $7.79 (1983) and a low of $4.83 (1999).

- Kentucky's soybean prices are lower than the national average, while its northern neighbor, Illinois, has the highest price in the nation.

- Soybean price differences between states often reflect the levels of processing. Illinois processes almost 95 percent of its crop, while Kentucky processes only 30 percent of its crop.

B. Kentucky's Diesel Fuel Market and Potential of Soy Diesel

- In 2001, Kentucky consumed an estimated 813 million gallons of on-highway diesel fuel[6] according to the Energy Information Administration.

- Diesel fuel consumption increased more than 120 percent from 1980 to 2001.

- Kentucky's lower soybean prices and high diesel prices provide an ideal situation for developing alternative fuels from renewable agricultural resources such as soybeans.

- Soy diesel, if used at a 2 percent or 5 percent with petroleum diesel, would use 23 to 57 percent of Kentucky's soybean crop and add 70 to 158 percent of soybean processing capacity within the state.

- A 20 percent soy diesel blend would consume Kentucky's current soybean crop and establish the state as a major processor of soybean products.

[6] Kentucky railroads used 100 million gallons in 2001. Source, Energy Information Administration.

C. Impact on Kentucky's Soybean Industry

1. Soybean Supply

- At 813 million gallons petroleum diesel consumption annually, a blend of 2 percent or 5 percent soy-diesel would require approximately 9.96 to 24.3 million bushels of soybeans. This is 23 to 57 percent of Kentucky's annual soybean crop.

- Total output impact of soybean production: $64 million to $160 million with a 5 percent blend.

- A 20 percent blend processed in the state would claim the current $223 million crop, encourage increased bean production, raise instate prices and require imports from other states.

2. Soybean Processing

- Soybean processing capacity in Kentucky would increase by 70 percent to 158 percent with a 5 percent blend; 576 percent with a 20 percent blend.

- Soybean oil production would increase by as much as 270 million pounds, adding $20 million to $50 million in output value with a 5 percent blend.

- Soybean meal production would increase by 473 million pounds to 1133 million pounds adding $62 million to $151 million in output value with a 5 percent blend.

- Total output impact of soybean processing: $86 million to $210 million with a 5 percent blend; $760 million with a 20 percent blend.

D. Impact on Kentucky's Economy

1. Total Output Impact

Total output impact includes direct, indirect, and induced effects to all economic sectors due to increased production output associated with additional soybean production and processing.

- Total output impact at 2 percent soy diesel blend ratio: $234 million.

- Total output impact at 5 percent soy diesel blend ratio: $571 million.

- Total output impact at 20 percent soy diesel blend ratio: $2.16 billion.

2. Total Employment Impact

Total employment impact includes the number of jobs in all economic sectors associated with additional soybean production and processing from direct, indirect and induced effects.

- Total employment impact at 2 percent soy diesel blend ratio: 1,240 jobs.
- Total employment impact at 5 percent soy diesel blend ratio: 3,020 jobs.
- Total employment impact at 20 percent soy diesel blend ratio: 10,600 jobs.

3. Tax Revenue Impact

The economic expansion occurring as a result of increased soybean production and processing will generate tax revenue that can be used to reduce shortfalls during economic contractions and increase expenditures or reduce taxes during expansions. Estimates for revenues are conservative.

- Total tax revenue impact at 2 percent soy diesel blend: $28.2 million.
- Total tax revenue impact at 5 percent soy diesel blend: $68.5 million.
- Total tax revenue impact at 20 percent soy diesel blend: $245 million.

V. Consumer Costs and Benefits

At present, expected costs and benefits are mixed. Soy-diesel costs slightly more than petroleum diesel. The difference is expected to diminish in coming years as bio-diesel processing technology improves. Petroleum diesel prices are also expected to rise in response to the clean air legislation enacted by Congress to begin in the middle of this decade.

Even at less than 1cent per gallon, cost increases will exist. Truck and busing industries will be most visibly affected because although they only account for 6 percent of the mileage driven, they account for a much higher proportion of the diesel consumed (they also account for 20 percent of the pollution). Some of the cost increases will be borne by the company and some by retail consumers with actual proportions dependent on the bio-diesel consuming companies' price elasticity of demand for fuel.[7]

Benefits also exist. As demonstrated above, significant tax revenues will be created as a result of the production and consumption of bio-diesel. Jobs and associated revenues will be created as environmental legislation mandates increasingly ecologically friendly fuel. It should be noted that the states that are quickest to mandate bio-diesel fuels will reap the greatest benefits because they will provide the demand necessary to encourage investment in bio-diesel processing plants. Laggard states will primarily be consumers and will fail to reap many of the economic benefits available due of this change in technology. Iowa State university economists maintain that for each $1 generated in the soybean processing industry an additional $1.50 is generated in the service sector.

Consumers will also benefit from the lower taxes required by the federal government to finance soybean program costs. As the amount of bio-diesel increases in the petroleum-organic matter blends, soy bean prices will rise accordingly. Most economists believe that a B20 blend would be large enough to eliminate federal price assistance programs for oilseeds.

Consumers will also benefit in the long term as disease causing toxic pollutants are eliminated or reduced in response to increased bio-diesel use. Many expensive diseases (notably cancer) are associated with petroleum diesel use.

[7] This would be an important study. Such data does not exist at present but will significantly effect consumer net benefits.

VI. Soy Diesel Processing in Caldwell Co., KY – Economic Benefits

A. Introduction

The information that follows provides an analysis of the county and area economic impacts that could potentially occur as a result of the operation of a soy diesel processing plant located in Caldwell County in West Kentucky. It should be noted that the methodology used to derive this information was initially offered by Jia, Scott and Johnson, 1999.

It should be noted from the outset that the focus of this brief treatment of a complex subject is strictly defined. It is an examination of the possible economic effects of a newly constructed bio-diesel plant. It is not a feasibility study. A feasibility study would include detailed information on health and safety regulations, a treatment of possible environmental effects and regulations, technological issues and a broader examination of a plethora of economic variables and variations. What follows is a benefit/cost analysis.

The site chosen for the hypothetical bio-diesel plant is Princeton, Kentucky, county seat of Caldwell County, Kentucky. Princeton is a small town located in the western part of the state, almost exactly 100 miles north by northeast of Nashville, Tennessee. A substantial number of its citizens are employed in retail trade and light manufacturing. In recent history industrial growth has slowed during a prosperous, expansionary period in most of the US. County population (12,891) growth has stagnated and will, according to projections made by the University of Louisville and the Kentucky Cabinet for Economic Development, begin to decline. Economic growth has also slowed and has occurred only in a manufacturing sector where wages are less than 70 percent of the national average. Unemployment has been slightly higher than both state and US averages (until 2002). Outmigration is evidenced by the fact that there are fewer residents in the county that belong to the 25-34 age cohort than in the 35-44 or 45-54 cohorts. The numbers of citizens in the younger group are only slightly higher than exist in the 55-64 cohort. The potential labor supply in Caldwell County is 229 and 3,327 if area counties are included.[8] Future Labor[9] in Caldwell County is 849.

Per capita income in Caldwell County was $21,577 in 2000, while median household income was $28,686. The median home price was $42,000; less than half the value of homes sold in nearby Marshall and Calloway Counties.

Princeton is located on a major state highway (West Kentucky Parkway) and very near a US Highway (Interstate 24). It lies within a 600 mile radius of nearly 50 percent of the nation's population.

[8] Area counties include Trigg, Lyon, Christian, Hopkins, Lyon and Crittenden.
[9] Persons becoming 18 years of age.

Table 1. Employment by Major Industry by Place of Work in Caldwell County 2000

Industry	Employment	Percent
All Industries	4,072	100.0
Agriculture, Forestry and Fishing	26	0.6
Mining and Quarrying	66	1.6
Contract Construction	133	3.3
Manufacturing	929	22.8
Transportation and Public Utilities	204	5.0
Wholesale Trade	68	1.7
Retail Trade	1,013	24.9
Finance, Insurance and Real Estate	122	3.0
Services	724	17.8
State and Local Government	326	8.0
Others	0	0

Source: US Department of Labor, Bureau of Labor Statistics

Table 2. Average Weekly Wage: Caldwell County and US 2000

Industry	Caldwell	U.S.
All Industries	426	610
Mining and Quarrying	607	1,000
Contract Construction	423	641
Manufacturing	548	770
Transportation and Public Utilities	544	756
Wholesale and Retail Trade	304	434
Finance, Insurance and Real Estate	529	935
Services	345	577
State and Local Government	466	598

Source: US Department of Labor, Bureau of Labor Statistics

B. Soybeans and Bio-diesel in Caldwell County

Caldwell County, home to Kentucky Soybean Association headquarters lies on the border between District 1[10] and District 2[11]. These two districts produce more than three quarters of the soybeans produced in the state. The only soybean processing facility currently in Kentucky is located in Owensboro (Daviess County). Officials from Owensboro Grain claim to process approximately one-third of the Kentucky soybean crop.

It is assumed that a vertically integrated soybean crushing, oil de-gumming and refining, and bio-diesel production facility would be located in Caldwell County Kentucky. An

[10] District 1 counties include Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Livingston, Lyon, McCracken, Marshall and Trigg.
[11] District 2 counties include Caldwell, Christian, Crittenden, Daviess, Hancock, Henderson, Hopkins, Logan, McLean, Muhlenberg, Ohio, Simpson, Todd, Union and Webster.

initial investment of $9.1 million would be required to establish the plant. It would employ 87 employees will be able to crush 250 tons per day and will produce meal, bio-diesel and glycerol for sale.

Table 3. Quantities and Values of Inputs and Outputs[12]

	Daily Quantities	Price	Annual Values
Soybeans	226.75 metric tons	$207.00	$15,019,920
Crude Oil	55.91 kilo liters	$ 0.51	$ 8,946,000
Meal	194 metric tons	$170.00	$11,174,400
Bio-diesel	53.65 kilo liters	$ 0.72	$12,360,960
Glycerol	4.091 kilo liters	$ 1.85	$ 2,421,870

Given the level of soybeans produced in the area, little effect on soybean prices is expected from the operation of a single bio-diesel processing plant. However, if several plants were opened across the state, a definite price effect would occur.

The bio-diesel plant would have a very positive effect on the area surrounding Caldwell County. The plant is expected to hire 87 employees with an additional 150 jobs from the multiplier effects associated with bio-diesel fuel production. New industrial and commercial sales including that from bi-diesel would add $43,000,000 to $47,000,000 to the area while new income to the area would be greater than $15,000,000 annually. The initial plant investment would also create jobs in the construction industry. Unemployment would likely be diminished by approximately 1.0 to 1.3 percent.

Many of the economic effects on Caldwell and surrounding counties will arise through increased demand for housing, retail sales and other life enhancing products and services. Population in Caldwell County would stop declining and would increase. Increased property values and associated assessments would increase funding for local education. Increased expenditures would also be available for county road improvements, county courts and general administration.

[12] See Jia, Johnson and Scott.

Appendix A.

Biodiesel and the Market for Yellow Grease

Yellow grease is composed of used cooking oil and other fats. It is either purchased or collected from food preparation facilities. Used cooking oil can be either a vegetable oil or animal fat while other fats would include the grease collected when meat products are produced. Yellow grease is processed by removing the solid elements from the above-mentioned sources.

By far the most common use for yellow grease is livestock feed. Yellow grease may be combined with other grease products or animal fats and sold to pet food manufacturers or other animal feed suppliers. Fats and oils are often blended to meet buyer specifications.

From the outset, it must be stated that the economics of yellow grease are not well known due to the lack of a mature market for the product. Data does not exist regarding historical prices, supplies, demands or costs. *Render Magazine* (April 2002), estimates that the domestic production of grease was 3.17 billion pounds (no estimate for yellow grease). USDA estimated the amount of yellow grease at 2.633 million pounds while in 1993 Hunter and Applewhite estimated yellow grease production at 1.5 million pounds. Quoted prices are often spot prices (anecdotal information from some a given source at some time) because of the various possible compositions of yellow grease. Briefly, the information should be considered unreliable.

Most yellow grease is collected from urban areas.[13] The scarcity of sources in rural areas coupled with low product prices make collection less profitable. Depending upon the area and the grease market in that area, yellow grease may be collected from cooking industries under conditions where the renderer pays for the product or where the render is paid by the producer to remove it.

Yellow grease can be used in combination with petroleum to produce a bio-diesel blend with many of the same characteristics as soybean diesel. In fact, yellow grease itself is a fuel itself given modifications to a diesel engine.

Yellow grease is often seen as an attractive alternative to soybean oil since the price of yellow grease is much lower. While both soybean oil and yellow grease prices vary, soybean oil prices usually vary with in a band of 13 cents to 30 cents per pound. Yellow grease generally varies from 7 cents to 16 cents per pound.

However, many factors will impact the degree to which yellow grease replaces soybean oil in bio-diesel formulation. First, soybean oil converts to a bio-fuel more quickly than yellow grease. Second, soybean oil is more uniform and less likely to be amended for

[13] Estimates range from 65 percent to 95 percent.

processing. Third, the soybean industry is much larger and more developed. Finally, soybean oil has a lower gel point.[14]

Dr. Rose Patzer of the Agricultural Utilization Research Institute is currently working on combining the properties of soybean oil with yellow grease to produce a cost efficient blend. Yellow grease provides the economy while soybean oil converts to bio-diesel more quickly and has a lower gel point.

At present, she is working on a B20 blend that includes 10 percent yellow grease methyl esters and 10 percent soy methyl esters and 80 percent petroleum diesel.

The future of yellow grease as a potential fuel is difficult determine given the lack of secondary information regarding the cost of building yellow grease bio-fuel processing facilities at present. A significant amount of primary research will also be necessary in order to determine the production costs, product prices and economic viability of the infant yellow grease bio-diesel industry.

[14] Some chemical analysts believe this is a minor point since yellow grease will be used primarily as an additive to petroleum products.