

PRODUCING BIODIESEL AND ALTERNATIVE FUELS AT THE LOCAL LEVEL

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Introduction

Traditionally in the cotton industry profits are generated by the sale of cotton lint to wholesalers and spinning mills, the sale of cottonseed to oil mills, and leaving cotton burs as a liability byproduct of the ginning process. The profit from the sale of cotton lint and cottonseed during the 2001 cotton season was minimal leaving the primary source of income to the revenues generated from cotton lint exclusively. With the recent drastic reduction of cotton lint prices on the open market for the 2002 cotton season producers and processors must look to new value-added methods for the cotton industry to survive.

Objective

To meet the need of new value-added methods in the cotton ginning industry Cimco, Inc. of Lubbock, Texas has introduced the Feed & Fuel Power System. The Feed & Fuel Power System is a vertically integrated agricultural system that produces feed, fertilizer, dry fuel pellets, and Biodiesel at the local level. Thus, enabling those involved in producing and processing cotton to become self-sufficient fuel providers.

This system incorporates processing cottonseed and cotton burs into the production of:

- 1) Meal
 - a) Organic Fertilizer (seed free)
 - b) Livestock and Fish Feed Supplement
- 2) Oil
 - a) Fuel Oil
 - b) Biodiesel Production
 - i) Farm Grade Fuel
 - 1) To Power Tractors
 - 2) To Power Irrigation Wells
 - ii) Electrical Power Generation
 - 1) Self Powered Plant Operation
 - 2) Sale of Excess Power as Wholesale Energy
 - iii) Liquid Fertilizer Byproduct
- 3) COBY (Cotton Byproducts) or Processed Cotton Burs
 - a) Organic Fertilizer (seed free)
 - b) Livestock Feed Supplement
 - c) Fuel Pellets

During the Feed and Fuel Power System process cottonseed is extruded producing cottonseed meal and cotton oil. The meal is usable as an organic fertilizer or a livestock and fish feed. After the oil is extruded from the cottonseed it undergoes a multi-stage process and is converted into Biodiesel, or can be used in its raw state as a fuel oil. Then, the COBY (Cotton Byproduct) is converted into valuable organic fertilizer; livestock feed, or fuel pellets depending on current market values.

Market Analysis

The Feed and Fuel Power System can be applied in four phases:

1. Seed Extrusion
2. Pelletizing of COBY
3. Biodiesel Production
4. Power Generation

The incremental implementation of the four phases allows for a segmented investment in the system thus, minimizing capital expenditures at the onset.

The following discussions are derived from the accounting presented in tables 1 through 5 located in the appendix.

Phase I. Seed Extrusion

Seed Extrusion typically accounts for 66% of the incremental increases in revenue due to an estimated 130% increase in cottonseed value, as shown in figure (1). This increase is attributed to the added value of cottonseed meal from extruded cottonseed. The cottonseed meal is cooked during the extrusion process sufficiently to sterilize the meal. The meal is then suitable for use as an organic fertilizer, or livestock feed. Typically the value for organic fertilizer and livestock feed are likely to follow the same economic trend, thus widening the market and minimizing over saturation. The oil that is produced from the extrusion process is typically stored for fuel oil and Biodiesel production at a later time.

Phase II. Pelletizing of COBY

Pelletizing of COBY typically accounts for 14% of the incremental increases in revenue due to an estimated wholesale price for Fuel Pellets of \$31.00 per ton, as shown in figure (1). Fuel Pellets are a developing market in the southern United States. Traditionally Fuel Pellets have been used to fuel pellet stoves in northern United States residential homes. However, markets in the South are increasing as fuel pellets become more readily available.

Phase III. Biodiesel Production

Biodiesel production typically accounts for 15% of the incremental increases in revenue due to an estimated value of \$1.18 per gallon at a production scale of 1,000,000 gallons annually, as shown in figure (1). Traditionally Biodiesel has been considered a European alternative fuel, due in part to high production and infrastructure costs. Market prices for transportation fuels in Europe are two or three times higher than what have been found in the United States for the past several years, thus justifying European interest. With the introduction of the Feed & Fuel Power System, for the first time in US history Biodiesel has become economically feasible. The justification for the recent economic feasibility is primarily due to the restructuring of Biodiesel infrastructure. Instead of seeking to distribute Biodiesel across the United States to the end user simply use it to fuel local farming equipment and cotton gins. Currently the estimated breakeven point for the production and sale of Biodiesel is \$0.87 per gallon.

As a background note Biodiesel is an alternative fuel made from vegetable oils or animal tallow's. Biodiesel can be used straight to fuel diesel powered equipment or as a blend with petroleum diesel fuel.

Phase IV. Power Generation

Power generation typically accounts for 5% of the incremental increases in revenue due to an estimated \$433,000 electrical consumption savings, as shown in figure (1). This savings is attributed to the installation of two 1500kWh generators, and connected to the power grid for co-generation. These generators should provide the majority of power required to operate the cotton gin during cotton processing. After the ginning season excess power could be sold back to the grid during the peak load seasons.

Conclusions

In conclusion with the introduction of the Feed & Fuel Power System we have moved from:

1. The dependence on foreign fuel - to - Becoming an independent local alternative fuel provider.
2. Fluctuating seed prices - to - Stable value added organic fertilizers and feed from cottonseed meal.
3. A liability of cotton waste products - to - Value added fuel pellets from COBY.

Appendix

Incremental Increases in Revenues by Phase

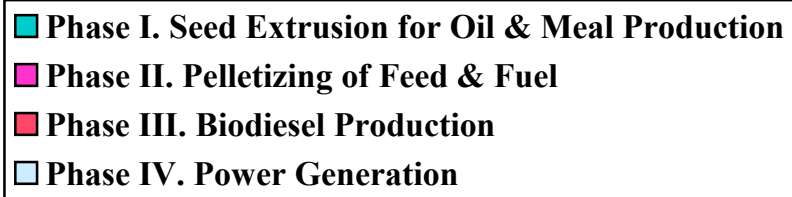
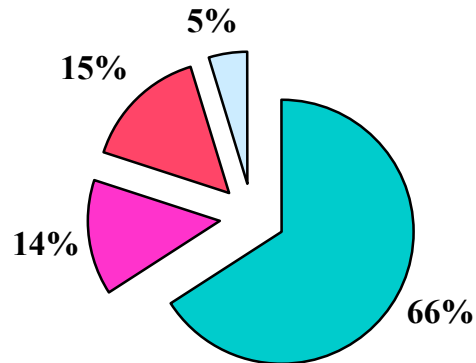


Figure (1) Incremental increases in revenues by phase application.

Table 1. Phase I. Seed Extrusion for Oil and Meal Production.

Cotton Seed Oil Production	Current Revenues & Expenditures	Proposed Revenues & Expenditures
Annual No. of Bales	80,000.00	80,000.00
Bale Rate (bales/hr)	50.00	50.00
Seed per Bale (lbs.)	800.00	800.00
Unprocessed Cotton Weight per Bale (lbs.)	1,750.00	1,750.00
Feed Filler Burr Weight (tons)	4,250.00	4,250.00
Fuel Pellet Burr Weight (tons)	12,750.00	12,750.00
Total Burr Weight (tons)	17,000.00	17,000.00
Oil per Ton of Seed (lbs.)	0.00	265.00
Total Oil Produced (lbs.)	0.00	8,480,000.00
Total Oil Produced (gal)	0.00	1,111,402.36
Cotton Seed & Burr Pricing		
Selling Price of Seed per ton	\$118.00	\$118.00
Less Cost EXPRESS Production & Maintenance	\$0.00	(\$224,000.00)
Total Seed Weight (tons)	32,000.00	32,000.00
Estimated Selling Price of Pelletized Meal per ton of Seed @ 130%	\$0.00	\$153.40
Total Meal + 25% Burrs Weight (tons)	0.00	32,090.00
Price of Seed	\$3,776,000.00	\$0.00
Estimated Price for Feed / Fertilizer Meal	\$0.00	\$4,922,606.00
Estimated Total Seed / Meal / Fuel Pellet Revenues	\$3,776,000.00	\$4,698,606.00
Energy Requirements & Cost		
Total Power (hp)	2,800.00	3,600.00
Total Power (kWh)	2,087.96	2,684.52
Cost per kWh	\$0.09	\$0.09
Cost per hour	\$177.48	\$228.18
Hours per day	22.00	22.00
Estimated Days of Cotton Production based on bales/hr.	73	73
Gas Costs per bale	\$3.20	\$0.00
Fuel Consumption for Drying (gal/hr)	120.00	57.00
Fuel Consumption for power (gal/hr)	0.00	0.00
Fuel Consumption for power & heat (gal/hr)	120.00	57.00
Total Fuel Use per Annual Cotton Production (gal)	192,000.00	91,200.00
Cost per Annual Cotton Production for Electricity	(\$283,962.56)	(\$365,094.72)
Cost per Annual Cotton Production for Gas	(\$256,000.00)	\$0.00
Total Energy Costs	(\$539,962.56)	(\$365,094.72)
Total Revenues & Expenditures	\$3,236,037.44	\$4,333,511.28
Estimated Annual Increase in Revenues		\$1,097,473.84
Estimated Increase in Revenues per Bale		\$13.72
Capital Costs		
Oil Press and related equipment (8 tons/hr)		\$1,538,943.12
Material Handling & Storage		\$1,324,180.00
Biodiesel Fuel & Oil Storage (16,800 gal tanks x 67)		\$562,404.70
Tank Farm Transport Fees		\$0.00
Multi-fueled Heaters & Moisture Units		\$138,520.43
Capital Costs Total		\$3,564,048.25
Estimated Payback (Yrs.)		3.25
Special Note: Farm Diesel @ \$1.18(gal) & Electrical Power @ \$ 0.085 (kWh).		

Table 2. Phase II. Pelletizing of COBY.

	Current Revenues & Expenditures	Proposed Revenues & Expenditures
Cotton Seed Oil Production		
Annual No. of Bales	80,000.00	80,000.00
Bale Rate (bales/hr)	50.00	50.00
Seed per Bale (lbs.)	800.00	800.00
Unprocessed Cotton Weight per Bale (lbs.)	1,750.00	1,750.00
Feed Filler Burr Weight (tons)	4,250.00	4,250.00
Fuel Pellet Burr Weight (tons)	12,750.00	12,750.00
Total Burr Weight (tons)	17,000.00	17,000.00
Oil per Ton of Seed (lbs.)	0.00	265.00
Total Oil Produced (lbs.)	0.00	8,480,000.00
Total Oil Produced (gal)	0.00	1,111,402.36
Oil for Fuel Pellets (gal)	0.00	133682.83
Cotton Seed & Burr Pricing		
Selling Price of Seed per ton	\$118.00	\$118.00
Selling Price of Fuel Pellets per ton	\$31.25	\$31.25
Estimated Price for Fuel Pellets	\$0.00	\$398,437.50
Less Cost EXPRESS Production & Maintenance	\$0.00	(\$359,660.00)
Total Seed Weight (tons)	32,000.00	32,000.00
Estimated Selling Price of Pelletized Meal per ton of Seed @ 130%	\$0.00	\$153.40
Total Meal + 25% Burrs Weight (tons)	0.00	32,090.00
Price of Seed	\$3,776,000.00	\$0.00
Estimated Price for Feed / Fertilizer Meal	\$0.00	\$4,922,606.00
Estimated Total Seed / Meal / Fuel Pellet Revenues	\$3,776,000.00	\$4,961,383.50
Energy Requirements & Cost		
Total Power (hp)	2,800.00	3,850.00
Total Power (kWh)	2,087.96	2,870.95
Cost per kWh	\$0.09	\$0.09
Cost per hour	\$177.48	\$244.03
Hours per day	22.00	22.00
Estimated Days of Cotton Production based on bales/hr.	73	73
Gas Costs per bale	\$3.20	\$0.00
Fuel Consumption for Drying (gal/hr)	120.00	57.00
Fuel Consumption for power (gal/hr)	0.00	0.00
Fuel Consumption for power & heat (gal/hr)	120.00	57.00
Total Fuel Use per Annual Cotton Production (gal)	192,000.00	91,200.00
Cost per Annual Cotton Production for Electricity	(\$283,962.56)	(\$390,448.52)
Cost per Annual Cotton Production for Gas	(\$256,000.00)	\$0.00
Total Energy Costs	(\$539,962.56)	(\$390,448.52)
Total Revenues & Expenditures	\$3,236,037.44	\$4,570,934.98
Estimated Annual Increase in Revenues		\$1,334,897.54
Estimated Increase in Revenues per Bale		\$16.69
Capital Costs		
Oil Press and related equipment (8 tons/hr)		\$1,538,943.12
Pelletizer (8 tons/hr)		\$280,280.00
Material Handling & Storage		\$1,324,180.00
Biodiesel Fuel & Oil Storage (16,800 gal tanks x 67)		\$562,404.70
Tank Farm Transport Fees		\$0.00
Multi-fueled Heaters & Moisture Units		\$138,520.43
Capital Costs Total		\$3,844,328.25
Estimated Payback (Yrs.)		2.88

Special Note: Farm Diesel @ \$1.18(gal) & Electrical Power @ \$ 0.085 (kWh).

Table 3. Phase III. Biodiesel Production.

	Current Revenues & Expenditures	Proposed Revenues & Expenditures
Cotton Seed Oil Production		
Annual No. of Bales	80,000.00	80,000.00
Bale Rate (bales/hr)	50.00	50.00
Seed per Bale (lbs.)	800.00	800.00
Unprocessed Cotton Weight per Bale (lbs.)	1,750.00	1,750.00
Feed Filler Burr Weight (tons)	4,250.00	4,250.00
Fuel Pellet Burr Weight (tons)	12,750.00	12,750.00
Total Burr Weight (tons)	17,000.00	17,000.00
Oil per Ton of Seed (lbs.)	0.00	265.00
Total Oil Produced (lbs.)	0.00	8,480,000.00
Total Oil Produced (gal)	0.00	1,111,402.36
Oil for Fuel Pellets (gal)	0.00	133682.83
Cotton Seed & Burr Pricing		
Selling Price of Seed per ton	\$118.00	\$118.00
Selling Price of Fuel Pellets per ton	\$31.25	\$31.25
Estimated Price for Fuel Pellets	\$0.00	\$398,437.50
Less Cost EXPRESS Production & Maintenance	\$0.00	(\$359,660.00)
Total Seed Weight (tons)	32,000.00	32,000.00
Estimated Selling Price of Pelletized Meal per ton of Seed @ 130%	\$0.00	\$153.40
Total Meal + 25% Burrs Weight (tons)	0.00	32,090.00
Price of Seed	\$3,776,000.00	\$0.00
Estimated Price for Feed / Fertilizer Meal	\$0.00	\$4,922,606.00
Estimated Total Seed / Meal / Fuel Pellet Revenues	\$3,776,000.00	\$4,961,383.50
Energy Requirements & Cost		
Total Power (hp)	2,800.00	3,850.00
Total Power (kWh)	2,087.96	2,870.95
Cost per kWh	\$0.09	\$0.09
Cost per hour	\$177.48	\$244.03
Hours per day	22.00	22.00
Estimated Days of Cotton Production based on bales/hr.	73	73
Gas Costs per bale	\$3.20	\$0.00
Fuel Consumption for Drying (gal/hr)	120.00	57.00
Fuel Consumption for power (gal/hr)	0.00	0.00
Fuel Consumption for power & heat (gal/hr)	120.00	57.00
Total Fuel Use per Annual Cotton Production (gal)	192,000.00	91,200.00
Cost per Annual Cotton Production for Electricity	(\$283,962.56)	(\$390,448.52)
Cost per Annual Cotton Production for Gas	(\$256,000.00)	\$0.00
Total Energy Costs	(\$539,962.56)	(\$390,448.52)
Biodiesel Production		
Total Biodiesel Production @ 98% of input volume (gal)		958,165.14
Material cost per input gallon (chemicals)		\$0.64
Overhead cost per input gallon (labor & maintenance)		\$0.15
Total Operating costs per gallon of Biodiesel		(\$0.79)
Total Cost of Biodiesel Production		(\$756,950.46)
Biodiesel Revenues from Excess Production		
Current Local Farm Diesel cost per gallon		\$1.18
Excess Fuel (gal)		866,965.14
Revenues from Biodiesel		\$1,023,018.86
Total Revenues & Expenditures	\$3,236,037.44	\$4,837,003.38
Estimated Annual Increase in Revenues		\$1,600,965.94
Estimated Increase in Revenues per Bale		\$20.01
Capital Costs		

Oil Press and related equipment (8 tons/hr)	\$1,538,943.12
Pelletizer (8 tons/hr)	\$280,280.00
Biodiesel Plant (6000 gal/day for 24 hr. day)	\$1,072,500.00
Material Handling & Storage	\$1,324,180.00
Biodiesel Fuel & Oil Storage (16,800 gal tanks x 67)	\$562,404.70
Tank Farm Transport Fees	\$0.00
Multi-fueled Heaters & Moisture Units	\$138,520.43
Capital Costs Total	\$4,916,828.25
Estimated Payback (Yrs.)	3.07

Special Note: Farm Diesel @ \$1.18(gal) & Electrical Power @ \$ 0.085 (kWh).

Table 4. Phase IV. Power Generation.

	Current Revenues & Expenditures	Proposed Revenues & Expenditures
Cotton Seed Oil Production		
Annual No. of Bales	80,000.00	80,000.00
Bale Rate (bales/hr)	50.00	50.00
Seed per Bale (lbs.)	800.00	800.00
Unprocessed Cotton Weight per Bale (lbs.)	1,750.00	1,750.00
Feed Filler Burr Weight (tons)	4,250.00	4,250.00
Fuel Pellet Burr Weight (tons)	12,750.00	12,750.00
Total Burr Weight (tons)	17,000.00	17,000.00
Oil per Ton of Seed (lbs.)	0.00	265.00
Total Oil Produced (lbs.)	0.00	8,480,000.00
Total Oil Produced (gal)	0.00	1,111,402.36
Oil for Fuel Pellets (gal)	0.00	133682.83
Cotton Seed & Burr Pricing		
Selling Price of Seed per ton	\$118.00	\$118.00
Selling Price of Fuel Pellets per ton	\$31.25	\$31.25
Estimated Price for Fuel Pellets	\$0.00	\$398,437.50
Less Cost EXPRESS Production & Maintenance	\$0.00	(\$359,660.00)
Total Seed Weight (tons)	32,000.00	32,000.00
Estimated Selling Price of Pelletized Meal per ton of Seed @ 130%	\$0.00	\$153.40
Total Meal + 25% Burrs Weight (tons)	0.00	32,090.00
Price of Seed	\$3,776,000.00	\$0.00
Estimated Price for Feed / Fertilizer Meal	\$0.00	\$4,922,606.00
Estimated Total Seed / Meal / Fuel Pellet Revenues	\$3,776,000.00	\$4,961,383.50
Energy Requirements & Cost		
Total Power (hp)	2,800.00	3,850.00
Total Power (kWh)	2,087.96	2,870.95
Cost per kWh	\$0.09	\$0.00
Cost per hour	\$177.48	\$0.00
Hours per day	22.00	22.00
Estimated Days of Cotton Production based on bales/hr.	73	73
Gas Costs per bale	\$3.20	\$0.00
Fuel Consumption for Drying (gal/hr)	120.00	57.00
Fuel Consumption for power (gal/hr)	0.00	170.00
Fuel Consumption for power & heat (gal/hr)	120.00	227.00
Total Fuel Use per Annual Cotton Production (gal)	192,000.00	363,200.00
Cost per Annual Cotton Production for Electricity	(\$283,962.56)	\$0.00
Cost per Annual Cotton Production for Gas	(\$256,000.00)	\$0.00
Total Energy Costs	(\$539,962.56)	\$0.00
Biodiesel Production		
Total Biodiesel Production @ 98% of input volume (gal)		958,165.14
Material cost per input gallon (chemicals)		\$0.64
Overhead cost per input gallon (labor & maintenance)		\$0.15
Total Operating costs per gallon of Biodiesel		(\$0.79)
Total Cost of Biodiesel Production		(\$756,950.46)

Biodiesel Revenues from Excess Production

Current Local Farm Diesel cost per gallon	\$1.18
Excess Fuel (gal)	594,965.14
Revenues from Biodiesel	\$702,058.86

Total Revenues & Expenditures	\$3,236,037.44	\$4,906,491.90
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Estimated Annual Increase in Revenues	\$1,670,454.46
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Estimated Increase in Revenues per Bale	\$20.88
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Capital Costs

Oil Press and related equipment (8 tons/hr)	\$1,538,943.12
Pelletizer (8 tons/hr)	\$280,280.00
Material Handling & Storage	\$1,324,180.00
Biodiesel Plant (6000 gal/day for 24 hr. day)	\$1,072,500.00
Diesel Generator (2 x 1500 kWh)	\$1,029,600.00
Diesel Generator Trailer	\$34,320.00
Biodiesel Fuel & Oil Storage (16,800 gal tanks x 67)	\$562,404.70
Tank Farm Transport Fees	\$0.00
Multi-fueled Heaters & Moisture Units	\$138,520.43
Capital Costs Total	\$5,980,748.25

Estimated Payback (Yrs.)	3.58
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Special Note: Farm Diesel @ \$1.18(gal) & Electrical Power @ \$ 0.085 (kWh.

Table 5. Input Data.

Cotton Seed Oil Production	Standard	Alternate
Annual No. of Bales	80,000.00	
Bale Rate (bales/hr)	50.00	
Seed per Bale (lbs.)	800.00	
Oil per Ton of Seed (lbs.)	265.00	
Unprocessed Cotton Weight per Bale (lbs.)	1,750.00	
Cotton Seed Pricing		
Selling Price of Seed per ton	\$118.00	
Increased Percentage of Cotton Seed Sold as Meal	130.00%	
Selling Price of Fuel Pellets per ton	\$31.25	
Energy Requirements & Cost		
Total Power (hp)	3,850.00	
Gin Power (hp)	2,800.00	
Express Power (hp)	800.00	
Pellet Mill Power (hp)	250.00	
Cost per kWh	\$0.0850	
Hours per day	22.00	
Gas Costs per bale	\$3.20	
Fuel Consumption for Drying (gal)	120.00	57.00
Fuel Consumption for power (gal)	170.00	
Biodiesel Production		
Material cost per input gallon (chemicals)	\$0.64	
Overhead cost per input gallon (labor & maintenance)	\$0.15	
Biodiesel Revenues from Excess Production		
Current Local Farm Diesel cost per gallon	\$1.18	
Number of Biodiesel Fuel & Oil Storage (16,800 gal tank)	67.00	
No. of Multi-Fueled Burners		
4 mBtu	1	
6/8 mBtu	1	
No. of Multi-Fueled Moisture Units		
2 mBtu	1	