

**Costilla County Biodiesel**  
**FY 2010 ACRE Grant Final Report**  
**January 30, 2011**

**Prepared for: Colorado Department of Agriculture – Markets Division**  
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*Project Overview*

The Costilla County Commissioners' Office and the Costilla County Economic Development Council, Inc., a 501(c)(3) non-profit corporation, have worked together to create a small-scale, vertically integrated biodiesel production facility in Mesita, Colorado. The project was initially conceived in 2002 under the direction of the County Commissioners' Office. Mesita is home to the County's District #3 Road and Bridge Shop and the project is under the supervision of the County's Road and Bridge Department. The following is a timeline of major milestones for the project:

- December 2002 – Site plans submitted to the County's Planning and Zoning Office
- September 2003 – County distributes in-house written "Viability Analysis and Operating Plan" for public comment
- August 2004 – Construction of building facility begins
- November 2004 – USDA and EPA grant funds commence for production equipment
- July 2006 – First test batches of biodiesel are produced
- May 2008 – US Department of Energy grant funds commence for production equipment
- October 2008 – Ribbon-cutting ceremony, automation of canola oil and fuel processes complete
- January 2009 – Crestina Martinez replaces Joe Gallegos as District #3 Commissioner out due to term limits
- July 2009 – Automation of feedstock seed handling system is complete
- November 2009 – Biodiesel dry wash filtering system is installed
- October 2010 – Completion of meal cake auger and bin storage and handling system
- January 2011 – Completion of solar thermal preheating system for biodiesel production
- February 2011 – Projected completion of truck scale installation project
- May 2011 – Projected completion of all planned equipment installation projects at the facility

In October 2009 Costilla County submitted an Advancing Colorado's Renewable Energy Grant (ACRE) Program application on behalf of securing a feasibility study for the business structure and operations of the Costilla County Biodiesel Project. Costilla County was notified about the successful grant application in February 2010. In May 2010 the County Commissioners agreed to a contract with Ann Wilkinson, Agriculture Economist, Origin Farms Consulting for a Strategic Plan Study and with Gallegos Consulting LLC for a Financial and Engineering Analysis.

The biodiesel project was initially developed as a small economic development/renewable energy pilot project in a remote, rural area dominated by agriculture with large unemployment and low per capita income. The project is much smaller than typical US biodiesel plants and it uses a different type of feedstock – canola seed instead of soybeans. Furthermore, the project was developed to:

1. Test for suitable crops to process
  - a. Test feasibility to grow biofuel crops in the San Luis Valley

- b. Tests crops suitability to be locally processed into biodiesel and feed meal
2. Test the impact of running biodiesel in the County's diesel fleet
3. Test the feed meal co-product through inclusion in the local ranching sector
4. Educate the community, farmers, ranchers, etc. about biodiesel.

The initial goals of the facility have been met in that canola has proven to be a viable crop for local producers and an excellent feedstock for production, biodiesel has performed above expectations in the county fleet, the feed meal product has been received very well by local ranchers and there is widespread acceptance of biodiesel within the county.

Leveraging government funds has been critical to the development of the biodiesel project. Outside private investment dollars are almost nil in Costilla County with the exception of extraction industries like mining and timber. The County's commitment to matching project dollars for grant dollars has been critical for the development of the biodiesel project. However, it is well understood by the County that privatization options offer the best scenarios for the long term success and growth of this fledgling local industry. The consultants were hired thanks to ACRE grant funding to provide a professional and objective view of the project – evaluate its production process, potential, weaknesses, markets, inputs and next steps.

#### Key Findings

The following are the key findings from the Financial and Engineering Analysis for Costilla County Biodiesel and Feed Meal Plant prepared by Gallegos Consulting LLC.

The Gallegos Consulting technical team is comprised of a mechanical engineer, a chemical engineer PE and a Certified Public Accountant. The team was asked to review financial and engineering data for the Mesita biodiesel plant, which was constructed as an economic development pilot/prototype facility.

The consulting team looked at the economic impact of the project through a variety of lenses. The first measure was by using the Colorado IMPACT Economic Model. The Colorado Office of Economic Development and International Trade generously allowed the use of the model and helped to review the results. The results are summarized for the years 2006-2009. The results reveal that the project created an average of \$250,000/year of primary and secondary economic benefits to the county. The complete model scenarios are available in Appendices H and K of the report. These four years at the facility involved major infrastructure development. Biodiesel production rates went from 250-gallons in 2006 to 8,000-gallons in 2009. Increasing production and activity at the Mesita Plant will have a substantial economic impact on Costilla County. The impact of this plant with increased production can make it one of the largest economic development projects in the County today.

Operating and production costs have averaged 2-3% of the County's Road and Bridge Department budget from 2006-2010. Use of biodiesel fuel to displace petroleum diesel decreased the County's operating cost for the project by 38% in 2010. Grant income in 2010 provided \$1.74 towards the project for every dollar spent by the County.

Using observed data during site visits to the plant, a Chemical Engineer PE from MKEC Engineering Consultants estimated the production capacity of the plant to be 200gal/day per eight hour shift. Running multiple shifts, which is the ideal scenario for the seed crushing machines, the facility can produce 150,000gal/year based on 250 work days/year. This does not mean that maximum production capacity cannot exceed this level. The Mesita Plant has four 6YL model Chinese made crushers, three 4-

ton units and a 6-ton unit. This is supposed to give the Mesita Plant a crushing capacity of 18-tons of seed per day, which would produce 400gal/day of oil on one shift and thereby increase maximum capacity to 300,000gal/year. However, the Mesita Plant is clearly not achieving these advertised production rates. It is unclear whether greater familiarity and improved operations can lead to these advertised production rates, or if these rates will be unattainable.

The Financial and Engineering Analysis provided a “Future Considerations” section that looked at four scenarios. Option one – shutting down the Mesita Plant completely would appear to be a choice that makes little sense for the long term. The County will have spent almost a decade putting together this successful prototype. Such a decision would stop the flow of grant funds into the County, which has exceeded \$600,000 as of this writing. Road and Bridge dollars would revert back to the fund on an annual basis. The hedge that Costilla County has created on its diesel fuel, due to either high short term price spikes, or spot shortages will disappear. Furthermore, Costilla County would have a difficult time replacing the economic benefit that the Mesita Plant has already created by leveraging County funds.

Option two would keep production at its present level. This option will not increase costs, but according to the pro-forma modeling would not reduce the cost of the county subsidy. It would allow the County to maintain the current level of economic development. The issue with this option is that the Mesita Plant has already proven its prototype status and future grant funds may be more difficult to attain. The plant will also not be able to attract, or serve future demand from the farmers that desire to participate in the crop growing program for the Mesita Plant. Farmers were already turned away in 2010 due to concerns about available capital for crop purchases.

A third option for future direction would be to increase production and strive to ensure a more profitable facility. This would involve increased seed crushing rates, increased crop procurement from local farmers and the addition of multiple work shifts. Some small equipment modifications will likely be required to alleviate potential bottlenecks identified by the engineer, but nothing too significant. In order to achieve greater levels of production the Mesita Plant will need to deal with business issues that volume growth generates such as how to involve more farmers in the canola program, how to obtain capital to purchase more raw product from farmers, who will pay for capital improvements, how will additional biodiesel and feed meal be marketed and transported to new users, how can multiple work shifts be instituted, etc.

A fourth option would be to consider a “plant of the future” with a production capacity of .6MG/year and above. This larger plant would be an attempt to attain an economically profitable and self sufficient facility that can weather low fuel prices and other economic challenges that impact the biodiesel industry. A new feasibility study would be necessary for this option. In this option the assumption will be an ideal business and financially prudent situation where the plant is capable of being self-sustaining and providing for its own reinvestment to keep it a profitable operation in the long term. Pro-forma modeling shows that a .6MG-1MG capacity plant can achieve this sustained level of profitability given current diesel prices of \$2.75/gal. The INSIGHT model showed a net economic benefit of a 1MG facility to be almost \$4.75 million to Costilla County. If eight new jobs were created through this option it would decrease the unemployment percentage by 0.61%, which would be equivalent to 46 jobs in Alamosa County, or 1,838 jobs in the City of Denver. Of course the example used is a large volume capacity facility and may not be a practical expansion especially in the near future, but the net economic benefits to Costilla County from expanded biodiesel production are so large that serious consideration should be taken for such a venture.

The Gallegos Consulting team identified a not-for-profit entity for community organized agricultural operations that would be well suited to any future operations of a biodiesel plant. This is a 501c(5) entity, which is tax exempt. This entity type would allow the plant to be managed by a Board of Directors comprised of stakeholders focused on managing the operations of the plant. A 501c(5) entity would provide the Mesita Plant with the greatest flexibility in raising funds, allow a ready means to operate the plant as a separate business unit and continue the successful partnership between the Biodiesel Project, Costilla County and the Economic Development Council. Appendix F of the full report provides more details on this type of entity.

The following are the key findings from the Costilla County Biodiesel - Strategic Plan prepared by Ann Wilkinson. Ann Wilkinson holds a Ph.D. in Agricultural Economics from the University of Missouri (1989), a M.A. in Economics from the University of Missouri, Columbia (1985), and a B.S. in Economics from Colorado State University (1982).

Costilla County Biodiesel is currently a hybrid venture, operated by both the Costilla County Commissioners and the Costilla County Economic Development Council (CCEDC), Inc. To facilitate growth of Costilla County Biodiesel (CCB), it is proposed that the project's financial and operating structure be transitioned to a separate stand alone legal entity.

This transition to a separate legal entity will have several benefits for the operation of the facility:

- a. *Operations.* CCB would be run by a separate board of directors, and limit the responsibility that the County directly has for the day to day operations of the facility. Further, establishing a separate legal entity would limit the county's potential liability in the event of an operating loss due to financial, personnel, equipment failure or other reasons.
- b. *Improve Efficiencies.* Establishment of a separate operation would improve the operating efficiencies of CCB and reduce reliance on the county as a funding backup. Having a separate entity will require CCB to develop and execute a solid business and marketing plan that ensures the sustainability and growth of the entity.
- c. *Grant Funding.* Currently, the CCEDC acts as fiscal agent for CCB in many applications. Under a new non-profit structure CCB, would act as its own fiscal agent. CCEDC would no longer be responsible for grant administration and audits for CCB. CCEDC will have limited involvement in the ongoing operations of CCB.
- d. *Benefits from Outside Directors.* If CCB were to establish a separate legal entity, it would be guided by a board of directors that could provide financial, marketing, operating and administrative advice.

#### *Advantages to the Process*

Costilla County Biodiesel processes canola seed into vegetable oil, and then into biodiesel. The initial oil production process does not go through a chemical modification, and results in biodiesel that is better for the environment. The hexane solvent extraction method typically used by larger manufacturers isn't suited for small-scale processing because of high capital and operating costs, risks due to fire and explosions from solvents, and the sheer complexity. Biofuels processed from non-hexane methods have relatively lower green house gas emissions than conventional product.

*Canola in Costilla County*

Costilla County Biodiesel should be able to source enough canola from the county, and not need to go outside of the county to source canola feedstock for the plant’s operations. The table below depicts the planted canola acreage necessary to operate the plant at different levels of output. This table was calculated under the assumption that 2,595 pounds of canola seed are required to process 100 gallons of oil, and that each planted acre will yield 2,500 pounds of canola seed.

If the plant installs additional preconditioning equipment, oil yield will increase and acreage requirements will decrease. Also, if yield improvements are made at the farm level, the acreage requirements will go down.

Planted Acreage Required for Biodiesel Plant				
Output/Day	# Days/		Pounds	
Gallons/Day	Year	Total Output	Seedstock	Acreage
			Required	Requirement
100	250	25,000	648,750	260
200	250	50,000	1,297,500	519
400	250	100,000	2,595,000	1,038
600	250	150,000	3,892,500	1,557
800	250	200,000	5,190,000	2,076
1000	250	250,000	6,487,500	2,595
1200	250	300,000	7,785,000	3,114

At maximum capacity, the plant will require about 3,800 acres of planted canola. This can be sourced from the County’s production base. Costilla County harvests output from over 36,000 acres of various crops each year, with hay, barley, wheat and oats being the primary crops.

Currently, CCB is paying producers \$.18 per pound for canola seed. At that price, assuming a yield of 2,500 pounds per acre, producers will realize \$450 in gross returns from production per acre. In order to attract additional producers, it may be necessary to increase the price paid for canola over time. Other crops, specifically barley, may have greater estimated on-farm returns to production.

Relative Returns, Various Crops				
Crop	Yield	Basis	Price	Gross
Barley	135	bu/acre	3.90	527
Forage	1.95	tons/acre	179	349
Oats	59	bu/acre	2.30	135
Wheat	46	bu/acre	5.50	255
Canola	2,500	lbs/acre	0.18	450

Because there are no nearby processing facilities or terminal markets, the price that CCB needs to pay for canola will be influenced more by competing crops within the production area, than by national market prices of canola.

*Feed Meal Potential*

Feed Meal Potential					
Output/Day	# Days/ Year	Total Output	Pounds Seedstock Required	Pounds Feed Meal Produced	Cattle Supported On Meal
100	250	25,000	648,750	386,006	1,608
150	250	37,500	973,125	579,009	2,413
200	250	50,000	1,297,500	772,013	3,217
300	250	75,000	1,946,250	1,158,019	4,825
400	250	100,000	2,595,000	1,544,025	6,433
500	250	125,000	3,243,750	1,930,031	8,042
600	250	150,000	3,892,500	2,316,038	9,650

The canola based feed meal has tremendous potential in the county for the emerging beef cattle industry. In the San Luis Valley, cattle ranchers often feed protein supplements to range cattle in the winter from December through March. If we assume 2 pounds of protein supplement (oilseed meal) are fed per head per day, the total protein supplement required for the winter will be 120 days x 2 pounds per head per day = 240 pounds of feed meal. The feed meal from the biodiesel plant could potentially supply supplemental feed to 1,608 cattle at its current output of 100 gallons a day.

*Profile of Cattle Production in Costilla County*

Costilla County has 138 farms and ranches with beef cattle. The majority of these producers are cow/calf operations that market their offspring in October and November. The total inventory of cows in the Costilla County is estimated to be 7,893 head.

These cattle producers are primarily pasture-based producers and provide little supplemental feed during the spring and summer months. However, many of the producers in the area do provide supplemental feed in the winter months. The nearby counties of Conejos and Alamosa counties have some cattle production, with the possibility of selling meal to producers in these areas. There is very limited dairy, goat and lamb production in the tri-county area, making local beef producers one of the best market alternatives.

Beef Industry, 2007				
	Costilla	Conjijos	Alamosa	Tri-County
Farms	138	291	263	692
Cattle & Calves	7,893	31,434	15,240	54,567
Cows	5,137	19,964	4,386	29,487

### *Development of Feed Cake Marketing Effort*

Costilla County Biodiesel produces a very high quality feed cake. CCB may want to develop collateral marketing materials for the product that clearly describes how it is made, the nutrient content of the product, and the packaging sizes and pricing. Further, product packaging could be improved to include attractive product labeling with nutrient content. CCB may also want to develop a simple informational website describing the project, and the availability of feed meal. CCB currently distributes feed cake exclusively from the facility and sells the product by the truckload, by the 1,500 pound tote or by the 70 lb. sack. CCB may want to consider increasing the number of distribution outlets that carry the product.

### *Problems Encountered*

Contracts with the two consultants were agreed upon in May 2010. Original deadlines for drafts of the consultant reports were scheduled for October 2010. Both consultants asked for extensions through December 2010. Due to the unique nature of the Costilla County Biodiesel Project and based on the interim reports provided by the consultants, extensions were granted by the Project Manager as the ACRE program's final reporting and final invoicing deadlines would not appear to be impacted by granting the extensions. Edits and revisions on the reports continued through January until all parties were comfortable with the final versions of the consultant reports.

Regarding future operations of the Costilla County Biodiesel Project, the main problem currently being encountered at the Mesita Plant involves the oil seed crushing production capacity. As mentioned earlier in this report, the Mesita Plant has four 6YL model Chinese made crushers, three 4-ton units and a 6-ton unit currently in operation. In addition a second 6-ton unit has been procured, but has not been installed. The four crushers currently installed are supposed to give the Mesita Plant a crushing capacity of 18-tons of seed per day, which would produce 400gal/day of oil on one shift. As of this writing, current crushing capacity averages about 130-gallons/day and the engineer observed the likelihood of 200-gallon/day with improved operator performance. No one involved with the Mesita Plant has seen another canola crusher in operation, nor have they seen other Chinese model crushers operate other than their own. The Mesita Plant staff has not received any vendor training, or support regarding the seed crushing units. Therefore the staff has been on its own to understand how to efficiently and effectively operate the seed crushing machines. In addition equipment and infrastructure installation projects have been on-going and are scheduled to continue until May 1, 2011. Since the majority of installation work is done in-house, this detracts from focusing solely on production increases.

A major challenge facing the Mesita Plant is how and if it can increase oil crushing production to near advertised levels for the crushing units. Monthly production continues to incrementally improve at the facility, the question is – where is the production ceiling given current equipment configurations? An easy answer to increase production of the crushers is to simply run more seed through the machine; however, the efficiency of the oil extraction process dramatically decreases if too much seed is sent through the crusher at one time. Decreased efficiency leads to a very oily cake meal and therefore much more seed is required for a gallon of oil to be recovered. The challenge is to try and maintain a near 75% efficiency of oil extraction while achieving throughputs approaching the advertised levels for the seed crushing machines.

Utility costs, particularly electricity usage estimates have varied widely within the consultants' reports. Some estimates calculated current electricity costs against current biodiesel production levels, while other estimates attempted to extrapolate information from the total base load electrical infrastructure at the facility. In addition the Biodiesel Facility is a part of a larger county building complex and all electricity usage for the complex is currently run through the biodiesel meter. It is estimated that 75%

of the total electricity use at the complex is attributed to biodiesel production. There are plans to begin to isolate the biodiesel electricity usage and some electrical usage will be pulled off the biodiesel meter by March 1, 2011. In addition a solar thermal project for biodiesel production was installed in January 2011 and the facility should begin to see decreased electricity use through the solar thermal project. Estimates for future electricity use vary from \$60,000 for 1,000,000-gallons of production to \$185,000 for 300,000-gallons of production in the consultants' reports. As the facility increases production, isolates its electricity use and expands upon its use of other renewable and efficiency projects, a better understanding will be garnered about future electricity use for the Costilla County Biodiesel Project.

#### Next Steps

- ✓ Complete all planned equipment installation projects (projected for May 1, 2011)
- ✓ Evaluate designed crushing capacity versus actual crushing capacity on-site
- ✓ Determine the opinion of the Board of County Commissioners regarding future considerations
- ✓ Increase farmer participation in the canola crop program
- ✓ Engage community stakeholders regarding management transition for the plant
- ✓ Explore feasibility study funding for an expanded commercial biodiesel plant in Costilla County
- ✓ Institute multiple work shifts at the Mesita Plant
- ✓ Engage new markets for biodiesel and feed meal
- ✓ Implement new management entity for the project

#### Notable Successes

- It has been proven that biodiesel fuel can be produced in Costilla County, where the crops used as raw materials can be grown by local farmers.
- There is widespread acceptance of biodiesel and the concept of renewable energy within Costilla County.
- There is a high degree of confidence that has been established with the farming community, along with an understanding of the economics of producing canola and their ability to grow the raw materials for the plant.
- Costilla County has shown that anyone can readily adapt to using biodiesel in their vehicles, equipment and fleets with no modifications and no additional overall maintenance.
- Costilla County has had great success with biodiesel blends from B20-B80.
- There is a large and vigorous market for the feed meal co-product.
- There is now a model for economic development in Costilla County that involves many stakeholders (county government, farmers, ranchers, state and federal government, non-profit foundations, etc.) that already has had significant positive results with a good outlook for future developments.
- The project's success has been a result of excellent management, slow planned growth and a continual effort to identify and minimize overall project risks.
- The Mesita Plant has already produced a significant economic impact as a pilot/prototype facility. The project created an average of \$250,000/year of primary and secondary impacts to the county.
- The biodiesel agricultural based alternative energy project has acted like a lightning rod for obtaining grant based funding for the county.
- The Biodiesel Project is a good example of how a partnership between a local government and a non-profit economic development group can develop a business for the benefit of the community.

Project Expenditures

**Costilla County Biodiesel**

**FY2010 ACRE Grant**

**Project Expenditures**

***Previously Submitted***

ACRE Funds

Ann Wilkinson - Strategic Plan Study	\$3,000.00
Gallegos Consulting, LLC	
CPA fees	\$4,000.00
Report Compilation	<u>\$2,500.00</u>
<b>TOTAL ACRE FUNDS</b>	<b><u>\$9,500.00</u></b>

Matching Funds

Costilla County	
Project Administration	
June	\$465.00
<b>TOTAL MATCH FUNDS</b>	<b><u>\$465.00</u></b>

***Pending Final Payment for Invoicing***

ACRE Funds

Ann Wilkinson - Strategic Plan Study	\$6,000.00
	<u>\$3,000.00</u>
subtotal	\$9,000.00
Gallegos Consulting, LLC	
MKEC Engineering Consultants	\$4,686.78
	<u>\$786.02</u>
subtotal	\$5,472.80
CPA fees	<u>\$1,027.20</u>
subtotal	\$6,500.00

Matching Funds

Costilla County	
Project Administration	
July	\$390.00
August	\$705.00
September	\$375.00
October	\$120.00
November	\$315.00
December	\$360.00
January	<u>\$810.00</u>
subtotal	\$3,075.00

ACRE funds pending final invoicing **\$15,500.00**

Total match funds this period **\$3,075.00**

**TOTAL ACRE FUNDS** **\$25,000.00**

**TOTAL MATCH FUNDS** **\$3,540.00**