

**Vendor:**

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**Industry:**

Energy Production

**Project type:**

Renewable Energy

**Project goal:**

The goal of this project was to reduce the cost of bedding material and reduce the environmental impact of the operation.

**Study Prepared by:**

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**Date of Case Study:**

March 3, 2016

# Coaltec Energy Systems – Ohio Heifer Center Manure Gasifier

Ohio Heifer Center, South Charleston, Ohio

**OVERVIEW**

By drying the manure for bedding and using as gasifier to produce biochar and energy, the Ohio Heifer Center has found a way to reduce its dependency on neighboring land to manage their manure, save on bedding costs and potentially bring a new product to the agricultural markets in the form of biochar.

**BACKGROUND**

**“We previously spent \$800,000 a year on bedding.” said Paul Detwiler, general manager, Ohio Heifer Center.**

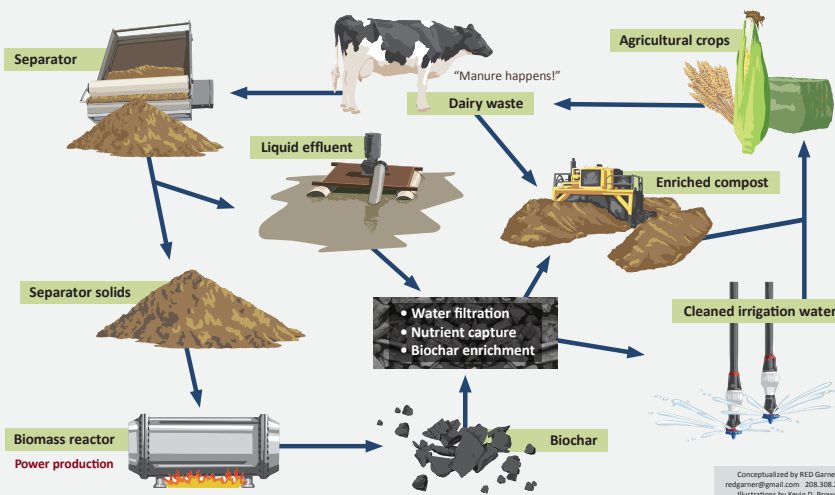
Coaltec Energy USA is an Illinois company that was founded in 2000. Since then, Coaltec has patented a technology that it has developed and tested over the years and in multiple locations. In 2003, Coaltec installed a test facility in Carterville, Illinois. This facility allows them to avoid many of the concerns about how fuels will respond to the gasification process, and because Coaltec installed a full, commercially sized facility, capable of processing 3,000 pounds per hour of most fuels, they do

not have to worry about scale-up issues. The facility, which has been upgraded with technology improvements as they have been identified, has conducted over 20 full scale tests of different fuels. Many of these tests involved 3rd party, certified stack emissions testing for a variety of compounds.

The Ohio Heifer Center in South Charleston, Ohio, decided that it didn’t want to depend on others to help to dispose of the farm’s manure. In order to take this responsibility into their own hands the farm set up a facility to recycle the manure for use directly on-farm as cow bedding. In doing this it has saved hundreds of thousands of dollars in bedding and it continues working to market a novel Biochar by-product.

## Biomass Upcycling Opportunities

*Reducing Bedding Costs and Environmental Impact at the same time.*



**Nutrient Removal Revenue Streams**

- Farm Tipping Fees
  - Carbon
    - ✓ Organic Based Fertilizers
    - ✓ Activated Carbon
    - ✓ Customize Blends
  - CO<sub>2</sub>
    - ✓ Algae Production
    - ✓ Carbon Activation
  - Syn-Gas
    - ✓ Electricity
    - ✓ Liquid Fuel
  - Heat
    - ✓ Electricity
    - ✓ Drying/Cooling
    - ✓ Steam
  - Environmental Credits
    - ✓ Renewable Energy
    - ✓ Nutrients
    - ✓ Carbon
- Scalable Decentralized Energy Parks**

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## KEY LEARNINGS

**There are many good gasification technologies that have a great deal of experience with wood but this one reliably processes manure.**

There are many good gasification technologies that have a great deal of experience with wood. There are, however, an extremely limited number of technologies that have experience with manure and other biomass fuels. Coaltec has tested a variety of fuels in their commercially sized demonstration facility over the last seven years. Coaltec has commercial experience gasification of poultry manure as well as several years of experience with packed bed dairy manure.

Coaltec’s system is able to gasify a variety of manures. The ability to make a project economically feasible is dependent upon a number of factors, including size of farm, quality of manure, energy needs, current manure management needs, etc. One of the first steps Coaltec does is evaluate these factors to determine the economic feasibility of a project. If the project is feasible Coaltec will provide a quote to the customer that will include design, fabrication, installation, start-up and support for the system.

## KEY BENEFITS

**Gasification provides an array of benefits.**

**These include:**

- The ability to turn by-products and out-of-spec materials into revenue streams
- Reducing or eliminating costs now associated with non-product material disposal
- Formulating various grades of Biochar from a variety of fuel sources, with those from animal manures having especially high value
- Greater potential for sale of by-products in more stable form
- Significant reduction of mass of original material decreases transportation costs
- Control over energy production
- Freedom from escalating energy prices and foreign control
- Destruction of odors as part of the gasification process
- Meeting manure management regulatory requirements with an alternative solution
- Halting the release of non-beneficial nutrients to waterways as a result of runoff from farm fields and storage piles
- Protection for a community’s economy that depends on clean air and water

## RESULTS

The gasifier produces 40 percent more energy than needed to run the manure dryer. The dryer operates 24 hours a day, five days a week—Monday through Friday producing bedding requirements for the dairy. In addition to heat for the bedding dryer, the gasifier produces a valuable biochar product, which is the mineral ash left from the manure. The dairy and Coltec are developing commercial opportunities for this product. Currently, the dairy adds biochar to the cattle pens and stalls where it acts like a litter to absorb ammonia.

### Total into the dryer:

20,000 lbs./hr.  
 8,500 lbs./hr. daily production  
 6,500 lbs./hr. old material  
 5,000 lbs./hr. recycle from dry

### Total out of the dryer:

12,500 lbs./hr.  
 3,000 lbs./hr. for energy Gasifier  
 5,000 lbs./hr. back to dryer  
 4,500 lbs./hr. for bedding  
 7,500 lbs./hr. water out (vapor)

### Energy stream:

97,000 lbs./hr. @ 600 F in  
 104,500 lbs./hr. @ 200 F out  
 36,500 lbs./hr. vented  
 68,000 lbs./hr. recycled

*Numbers are approximate and will change with operating conditions and changes in material.*

## CONCLUSION

The Coaltec Energy gasification system works! When it was observed from start-up the system was able to operate without outside fuel once it reached proper operating temperatures. The moisture of the initial manure is a big factor in determining if there will be an energy surplus in a project, the drier the material starts out the better chance that there will be an energy surplus.

The CoalTec Energy design appears to be robust and well thought out. The systems have a good operational history and seem to stand up well to the realities of daily dairy operation.

## Key Benefits & Results

### Summary:

- The Coaltec Energy design appears to be robust and well thought out.
- Has a good operational history.
- Stands up well to the realities of daily dairy operation.



The Coaltec Energy gasification manure dryer.



### NEWTRIENT

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## COALTEC ENERGY PROJECT BY THE NUMBERS

|   |   |
|---|---|
| <b>Location type</b>                        | Ohio Heifer Center, Sexing Technologies, South Charleston, Ohio   |
| <b>Number of animals</b>                    | 4,500 dairy animals   |
| <b>Type of bedding</b>                      | Straw and corn straw deep packed bedding  |
| <b>Manure collection</b>                    | Pens are cleaned by front end loader a vacuum truck is used to clean the scrape alleys and haul the manure to the handling facility.                        |
| <b>Daily flow</b>                           | 110 tons per day  |
| <b>System designed by</b>                   | Coaltec Energy  |
| <b>Date operational</b>                     | 2012  |
| <b>Energy produced/required</b>             | 40% more heat than is required for drying   |
| <b>Installed energy production capacity</b> | Dependant on feedstock  |
| <b>Products produced</b>                    | Thermal Energy and Biochar  |
| <b>Contracted prices</b>                    | Biochar typically sells for \$200–\$500 per ton based on a number of market factors. Coaltec has experience selling biochar between \$400 to \$500 per ton. |
| <b>Residual materials</b>                   | None  |
| <b>Residual storage</b>                     | None required   |
| <b>Residual use</b>                         | Not applicable  |
| <b>Ownership structure</b>                  | System is owned by dairy  |

## COALTEC ENERGY FINANCIAL INFORMATION

|  |   |
|--|---|
| <b>Capital investment</b>                    | \$1,500,000 for smallest standardized gasifier system. The total cost of a project may include other equipment and costs depending on the design of each individual system. Systems that include a gasifier with dryers and electricity generation can range from \$2.7 to \$5.5 million for total build out. |
| <b>Annual operating and maintenance cost</b> | Approximately \$220,000 per year for fully utilized standardized system.  |
| <b>Revenue</b>                               | Approximately \$450,000 per year for fully utilized standardized system at \$250 per ton of Biochar.  |
| <b>Payback period</b>                        | 6.5 years without bedding savings, <2.5 years with bedding savings.   |

## WHAT IS BIOCHAR?

Biochar is a Valuable Soil Amendment and is created using a 2,000 year-old practice to convert agricultural waste into a soil enhancer that can hold carbon, boost food security, and increase soil biodiversity, and discourage deforestation. The process creates a fine-grained, highly porous charcoal that helps soils retain nutrients and water.

Biochar is found in soils around the world as a result of vegetation fires and historic soil management practices. Intensive study of biochar-rich dark earths in the Amazon (terra preta), has led to a wider appreciation of biochar's unique properties as a soil enhancer.

Biochar may be an important tool to increase food security and cropland diversity in areas with severely depleted soils, scarce organic resources, and inadequate water and chemical fertilizer supplies. Biochar may also improve water quality and quantity by increasing soil retention of nutrients and agrochemicals for plant and crop utilization. By retaining the more nutrients stay in the soil instead of leaching into groundwater and causing pollution.

Biochar may be a Powerfully Simple Tool to Combat Climate Change because the carbon in biochar resists degradation and can hold carbon in soils for hundreds to thousands of years. When the biochar is as a soil enhancer, the system can become "carbon negative." Biochar and bioenergy co-production may help combat global climate change by displacing fossil fuel use and by sequestering carbon in stable soil carbon pools.

Source: <http://www.biochar-international.org/biochar>

For more information about Coaltec Energy USA, or to join our mailing list, email [info@newtrientllc.com](mailto:info@newtrientllc.com).

Newtrient's mission is to help all dairy farmers reduce the environmental footprint of manure while enhancing their economic opportunities and their social license to operate. The information contained in this case study was developed with the cooperation of the organizations involved and Newtrient has endeavored to make sure it is accurate and complete as possible.



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