

**BIOENERGY INNOVATION CENTER
SEAFORD, DELAWARE**

RECYCLING ANALYSIS

May 2022

Prepared for:

BioEnergy DevCo, LLC
50 State Circle
Annapolis, MD 21401

Prepared by:



Bioenergy Devco, LLC
A Division of
Bioenergy Development Group
28338 Enviro Way
Seaford, DE 19973

Project No. 12393.E

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1.0 INTRODUCTION

Bioenergy DevCo, LLC (BDC) purchased the Perdue AgriRecycle Composting facility in Seaford, DE in February 2020. BDC has retitled the facility as the Bioenergy Innovation Center (BIC). BIC is currently an operating composting facility that receives poultry by-products and wood waste, and processes these materials into compost. The compost is marketed under the name microStart™ Organic Compost, and is sold to landscapers, garden centers, farms, and manufacturers that use it as an ingredient in blended soils.

BDC is proposing to expand operations of BIC by constructing and operating an anaerobic digestion (AD) plant that will operate along with the existing compost facility, creating a comprehensive campus of organic waste recycling. The facility will receive and process poultry industry organic waste consisting of hatchery waste, liquid and solid cake dissolved air flotation (“DAF”), waste activated sludge (WAS) sludge, fats, oils, greases (FOG), and chicken litter and create two primary recycled products: biogas and composted or digestate soil amendments.

With dedicated management from BDC’s compost and soils senior leadership teams, the Seaford, Delaware-based Bioenergy Innovation Center has seen consistent improvements in its composting operations. These quality improvements have allowed BDC to build relationships with our core clientele, focusing on continued demand for high quality compost, as well as future soil formulations using digestate from the anaerobic digestion process.

Market demand has increased for these high-quality digestate based organic soil products driven by:

- Transition of numerous farms along the Eastern Seaboard to organics, (a minimum three-year transition process);
- The State and local demand for natural organics solutions to such issues as storm water management and highway reclamation; and
- Consumer focus on the replacement of fossil-fuel based soil products that further impact soil compaction, allowing for unneeded runoff or pesticides and high level of nutrients such as phosphorus and nitrogen.

As further evidence of this market demand, the State of Maryland has recently amended the Agriculture Article Section 6-201(cc)(2), to expand the definition of “soil conditioner” to include “digestate produced by anaerobic digestion” citing the equivalent organic qualities of digestate from the anerobic process with that of compost, opening up this lucrative market.

With this in mind, BDC has requested that under this permit, capacity at the current compost site to include an additional 26,000 tons of feedstocks per year for total capacity of 56,000 tons of feedstocks, including approximately 45,000 tons per year of recycled digestate and 11,000 tons per year of hatchery waste, DAF sludge and cake..

2.0 FEEDSTOCKS

As is the case with the existing composting facility, the proposed anaerobic digestion facility will be receiving and processing poultry industry organic waste consisting of liquid and solid cake DAF, waste activated sludge, fats, oils, greases (FOG), and chicken litter. Feedstocks for the anaerobic digester are free of contamination that would need to be separated prior to recycling. Received feedstocks are 100% recycled, and there are no residuals produced requiring disposal.

BDC has an executed contract with Perdue Foods to receive poultry organic wastes from their processing facilities and hatcheries on the Delmarva Peninsula, which accounts for approximately 70,000 tons per year. The contract was executed in November of 2019 and has a 15-year term with an option to renew for an additional 5 years. Negotiations are ongoing with the remaining major poultry processing companies on the Delmarva including Mountaire, Allen Harim, Amick, and Tysons. It is expected that similar contracts will be executed with each to receive and recycle their poultry by-products. As is the case with Perdue Foods, none of the anticipated feedstocks from these additional sources will contain residuals that require separation and disposal.

3.0 RECYCLED PRODUCTS

3.1. BIOGAS

BDC has executed biogas purchase agreements with Chesapeake Utilities Corporation (CUC) for all of the biogas produced at BIC.

The biogas upgrading system, single system with lead-lag vessels, will clean, scrub, and dry the biogas into a pipeline quality, renewable natural gas. The biogas is cleaned of particulate matter captured in the filters to be removed with a high-pressure cycle of waste gas sent to the thermal oxidizer. Moisture is also removed and sent to the wastewater treatment plant as a process water waste. The filtration system separates the CO₂ from the biogas, which can be vented or captured for sale when there is a market. VOCs and H₂S are trapped in specialty activated carbon medias, which are removed and taken offsite to be regenerated for reuse in replacement of the media in subsequent changeouts. The final product is a renewable natural gas of the same quality as pipeline natural gas and is sold accordingly.

CUC will be responsible for designing, constructing and operating the biogas upgrade system.

The RNG produced will be compressed and stored on truck trailers until the trailer is full, then trucked/transported to CUC facilities for interconnection to an interstate natural gas pipeline and delivered to their customers.

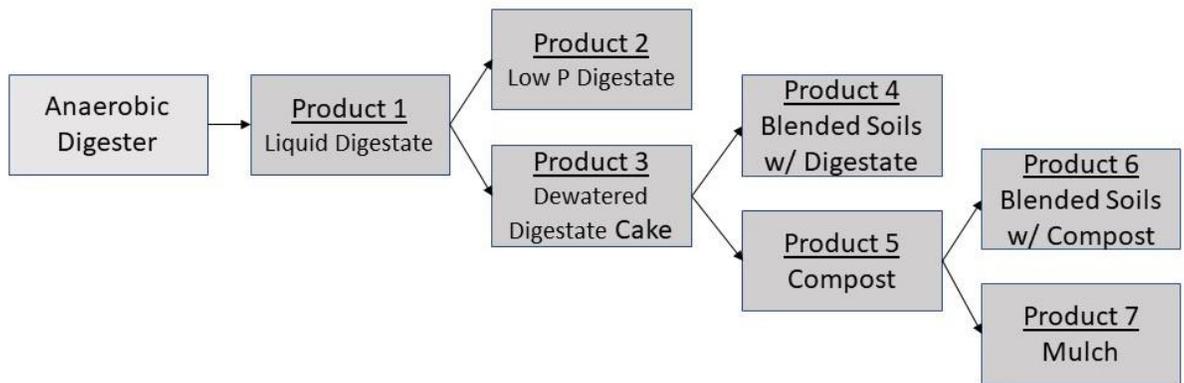
3.2. COMPOST AND DIGESTATE

The digestate generated by the anaerobic digester is an organic soil conditioner that can be sold to customers or further processed to increase its value and to reach additional markets. The unprocessed digestate is a liquid and can be used to increase organic matter and nutrients in agricultural fields, particularly when applying a solid amendment is difficult as is the case agroforestry.

Each of our proposed products are undergoing formulation analysis with various laboratories, including the University of Delaware. Each of the products will meet state requirements per nutrient management programs where within the anaerobic digestion process, we are ready to strip both phosphorus and nitrogen to meet our client’s product requirements and regulatory standards. The Delaware Department of Agriculture has demonstrated its support for the use of digestate on agricultural lands as part of a landowner’s Nutrient Management Plan (Appendix A).

3.2.1 Product 1 – Liquid Digestate

Market demand for liquid digestate is nascent and limited, and therefore we need to develop additional products using liquid digestate in order to create the demand that matches our anticipated supply. Liquid digestate serves as the basis for all other products produced at BIC, complementing our current offering of:



3.2.2 Product 2 – Low Phosphorous Digestate

Liquid digestate can be processed to remove phosphorus from the liquid digestate, creating a soil conditioner that is lower in phosphorus. The application of soil conditioners on agricultural land is often limited by the soil’s phosphorus levels, and removing phosphorus would allow farms to apply more digestate.

3.2.3 Product 3 – Dewatered Digestate Cake

Liquid digestate can be processed to remove excess moisture, creating a digestate cake that can be spread through common agricultural implements such as manure spreaders. The water that is removed from the liquid digestate is recycled back into the anaerobic digester or treated on-site and disposed of through either a central collection and treatment system or on-site. Dewatering digestate with a screw press and centrifuge results in a digestate cake with approximately 23% solids. Further evaporative drying is possible with dryers that use excess thermal heat, creating solid digestate with higher solids content. Amending agricultural fields with poultry litter is a common practice on the Delmarva Peninsula. Digestate cake will be marketed to farms that would otherwise apply poultry litter to amend soils sold and distributed into this marketplace.

3.2.4 Product 4 – Blended Soils with Digestate

Digestate cake from the anaerobic process will be blended with other ingredients to create blended soils such as manufactured topsoil, bioretention soil, green roof soil, and other manufactured soils in which organics plays an important role. Blended soils using digestate will be made to specifications of the customer, often based on specifications set forth by DelDOT and other governmental agencies.

3.2.5 Product 5 – Compost

Digestate will be used as a feedstock in the existing composting facility. The digestate cake will be co-composted with hatchery and wood waste and processed much like feedstocks are currently processed. BIC currently sells approximately 20,000 tons of compost per year, and the resulting compost will be sold to our current customer base. Our compost is certified by the Organic Materials Review Institute (OMRI) and approved by the US Compost Council Seal of Testing and Assurance (STA). These certifications drive customer demand and will be maintained in the future when digestate cake is used as a feedstock.

BIC currently only sells bulk compost. Much like manufactured soils using digestate cake, an expanded product line based using compost, including topsoil, potting soil, garden soils, will be available in both bulk and bagged formats.

3.2.6 Product 6 – Blended Soils with Compost

Similar to Product 4, the composted created at the existing compost facility can be blended with ingredients to make a range of manufactured soils. Some higher cost and higher performance blended soils, such as potting soils, may benefit from the composting process, while other lower cost soils, such as topsoil, can be manufactured with digestate cake.

3.2.7 Product 7 – Mulch

Wood is screened from the compost prior to selling. This wood is currently being recycled back into the beginning of the composting process and used numerous times. In the future, a mulch product may be manufactured by grinding this wood material.

3.2.8 Product 8 – Agricultural Prill

Also known as mini pellet, this product will be created using a combination of digestate, chicken litter, and hatchery waste currently in the compost process. This product will be sold in “super sacks” and take advantage of Perdue’s former client list created during the years in which they operated a pelletizing plant.

3.2.9 Current and Future Sales

The following represents BDC’s current customer list. This represents our partial outreach on possible sales of digestate sales as well as digestate use in soil formulations for use in the agriculture, turf, golf course, construction, land reclamation, roof garden, and consumer and government sales.

- H & H;
- Scott’s;
- Coast of Maine;
- Espoma;
- Reynold's Excavating, Inc.;
- Eastern Shore Forest Products;
- Southside Land Management;
- Glyndon Gardens;
- Stockley Materials;
- Bridge's Landscaping;

- Home Depot;
- Lowes;
- Old Castle Lawn & Garden;
- Hollins Organic Products; and
- Grizzly's Landscape & Supply.

4.0 SUMMARY

BDC has sold approximately 18,000 tons of compost in the period starting Feb 6th, 2020 and ending December 31, 2020 clearly demonstrating the ability to manage recycled organic products. While the marketing and customer base for digestate will build on the continued successful marketing of compost, the widespread use and demand for digestate will require BDC to continue product development and research.

BDC is developing research and test programs for the digestate and its derivative products in collaboration with the University of Delaware. The research and development efforts will explore new products, prove the effectiveness for numerous new applications. BDC is negotiating the establishment of a significant agricultural research presence at the nearby University of Delaware Carvel Research and Education Center, supplemented by research on fields at BIC.

APPENDIX A

DNREC DDA DIGESTATE SUPPORT CORRESPONDENCE



DELAWARE DEPARTMENT OF
AGRICULTURE

2320 SOUTH DUPONT HIGHWAY
DOVER, DELAWARE 19901
AGRICULTURE.DELAWARE.GOV

TELEPHONE: (302) 698-4500
TOLL FREE: (800) 282-8685
FAX: (302) 697-6287

Adam Schlachter
Program Manager
Delaware Department of Natural Resources and Environmental Control
Division of Waste and Hazardous Substances
89 Kings Highway
Dover, DE 19901

Dear Mr. Schlachter:

The purpose of this letter is to express the support of the Delaware Department of Agriculture (DDA) for the use of digestate produced by the Bioenergy Devco's Bioenergy Innovation Center (BDC BIC) as a soil amendment to be applied on farms in Delaware.

We understand that the digestate to be a byproduct of the anaerobic digestion process operated at the facility which will convert various feedstocks from the poultry industry into low phosphorous digestate, and low phosphorous dewatered digestate cake, along with renewable natural gas and compost. Alternative uses for manure, such as digestion, are among the technologically driven goals in the State's third Chesapeake Bay Watershed Implementation Plan.

According to information provided by BDC, the cake is expected to consist of about 0.0121% nitrogen, 0.0176% phosphorous and 0.0035% potassium by weight. As I expect you are aware, application of material that contain fertility elements must conform with Delaware's Nutrient Management regulations. This letter confirms that farmers in Delaware would be able to use digestate produced by the BIC under the state's Nutrient Management Program and could be included in the farm's Nutrient Management Plans.

I will also take this occasion to highlight that this material may also be subject requirements under the Delaware's Fertilizer and Soil Conditioner Law, including testing, reporting and registration, depending on how the materials are marketed.

We look forward to the addition of the BIC among Delaware's tools to effectively manage nutrients within the state's agricultural community.

Please feel free to contact me with any questions.

Sincerely,

Chris Brosch

Administrator, Delaware Nutrient Management Program

APPENDIX B
Letters of Support

GRIZZLY'S LANDSCAPE SUPPLY & SERVICES, INC.

PO Box 203
Lewes DE 19958-0203
www.grizzlycompost.com
302.644.0654

Division of Natural Resources & Environmental Control

To Whom It May Concern:

Grizzly's Landscape Supply is an active customer of the Bioenergy Innovation Center. We have purchased and resold their organic compost to much enthusiastic acclaim from our customers. It is our understanding that the company plans to integrate their existing compost facility with an anaerobic digester to expand the product line.

A product that I feel will be of interest to Grizzly's and our customers is the organic digestate which will help fertilize the barren soil here on Delmarva and elsewhere. Recycling poultry waste has been a challenge in our region for nearly 80 years. We fully support Bioenergy Innovation Center's efforts and success in recycling.

Please feel free to contact me if I may offer any further information in this matter.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard D. Pack". The signature is fluid and cursive, with the first name "Richard" being the most prominent.

Richard D. Pack, President
Grizzly's Landscape Supply & Services, Inc.

SOUTH SIDE

LAND MANAGEMENT

To Whom It May Concern:

Southside Land Management, LLC is a current customer of the Bioenergy Innovation Center, and we regularly purchase their compost. I understand that, in the future, they will be integrating their existing composting facility with an anaerobic digester, and they will be expanding their product line to include digestate from their anaerobic digester. I support their efforts to recycle more organic wastes on the Delmarva, and I am interested in either purchasing their digestate and/or continuing to purchase their high quality compost products.

Thank you,
Kelsie Leatherman
Southside Land Management, LLC
3447 Ocean Gateway
East New Market, MD 21631
410-310-6410



December 17, 2020

To Whom It May Concern:

Blue Hen Organics is a current customer of the Bioenergy Innovation Center and regularly purchases compost from their facility. We use the compost to manufacture topsoil and other specially blended horticultural products that are sold all over the Delmarva Peninsula. We also sell their compost to numerous landscapers, agricultural facilities, and use the material through our related entities: Baywood Greens, Cypress Tree Care, and Pot-Nets Landscaping.

I understand that in the future Bioenergy will be expanding their facility and building an anaerobic digester. We would be interested in purchasing the digestate which should be a very high-quality product that would be ideal for turf topdressing. We support their efforts to recycle organic waste on the Delmarva Peninsula and look forward to continuing to sell and use their quality compost.

Sincerely,

A handwritten signature in black ink, appearing to read "Rob W. Tunnell, III".

Robert W. Tunnell, III
Vice-President