GreenEdge®
GreenTechnologies, LLC

2023

Closing the Loop:

Advancing the Circular Economy through Organic Waste Recovery

GreenTechnologies, LLC

EcoLoop RFP 22-328-MM

GreenTechnologies, LLC
Office - UF Innovate:
747 SW 2nd Ave, Suite 326
Gainesville, FL 32601

Facilities:
6811 GreenEdge Trace
Jacksonville, 32234

Phone: 1-877-473-3630
Email: info@green-edge.com
www.green-edge.com

Date: July 26, 2023

To: Mr. Gus Olmos, P.E. Director

From: GreenTechnologies, LLC

Subject: EcoLoop RFP 22-328-MM - Proposal for GreenEdge® Renewables Facility

Dear Mr. Olmos and Commissioners,

With immense enthusiasm and unwavering commitment to sustainability, GreenTechnologies, LLC, proudly presents its proposal for the GreenEdge® Renewables Facility – Organics and Nutrient Recycling at the Alachua County EcoLoop site.

We are driven by a passion to revolutionize organic waste management practices and create a more environmentally responsible future. Our comprehensive proposal outlines a visionary organic waste recycling facility that will pave the way for a greener, cleaner Alachua County.

At the heart of our proposal lies the deployment of proven anaerobic digestion technology, to process food waste and other organic wastes. The process of anaerobic digestion will generate Renewable Natural Gas (RNG) and produce a nutrient-rich byproduct known as digestate, which we will transform into high-quality, Renewable Fertilizers. By doing so, we ensure a closed-loop system where waste transforms into an asset, contributing to the enrichment of agricultural, residential, and commercial landscapes within Alachua County and beyond.

GreenTechnologies takes great pride in our long-standing expertise in nutrient recovery and organic fertilizer manufacturing. Our two decades of experience in development and production of renewable GreenEdge brand of organic fertilizer, stands as a testament to our unwavering commitment to sustainability.

Furthermore, we are thrilled to share that our proposal includes a strategic collaboration with major players in the Renewable Natural Gas sector. This partnership not only bolsters the economic feasibility of the project but also amplifies the positive impact it will have on our environment and the community at large.

Alachua County's zero waste initiative has captured our vision, and we believe that the GreenEdge® Renewables Facility is the missing piece in the puzzle, accelerating the county towards its bold ambitions.

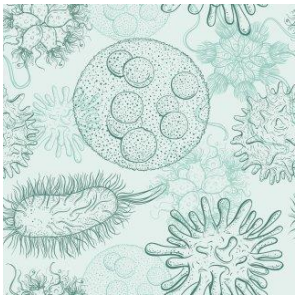
Thank you for considering our proposal and we are looking forward to the prospect of partnering with Alachua County to contribute to your esteemed vision.

Respectfully,

Dr. Amir Varshovi, CEO

Proposed Process and Technologies

Figure 1: Microbes



Source: From *Basic Information about Anaerobic Digestion (AD),* by EPA, 2022. (https://www.epa.gov/anaerobic-digestion/basic-information-about-anaerobic-digestion-ad).

Anaerobic Digestion

Anaerobic digestion is the "process through which bacteria break down organic matter—such as animal manure, wastewater biosolids, and food wastes—in the absence of oxygen."[1] The key to the technology is in the community of microbes (Figure 1) within the reactor that eat up the food waste and transform the materials into biogas and digestate.

The use of anaerobic digestion is a well-established technology with a long history of success in municipal solid waste processing. The technology was first introduced in the early 1990s and has since been implemented across the globe as a solution for organic waste recovery. For example, Germany leads the world in anaerobic digestion with about 10,000 facilities in place. In the US, there are just over 2,000 anaerobic digesters and only a few hundred are currently used for food waste, though this number is rapidly expanding.[2] In fact, the EPA's "Biogas Opportunities Roadmap" identifies over 11,000 additional sites where anaerobic digestion could be established to treat and reuse organic waste. If all these facilities are built, there would be enough energy generated to power 3 million homes.[3]

After the digestion process is complete, there are two outputs: biogas and digestate. Both outputs are revenue-generating and can serve as renewable alternatives to fossil fuel commodities.

Biogas-to-Renewable Natural Gas: Process and Technology

The principal carbon-based products of biogas are carbon dioxide (CO_2) and methane (CH_4). Upgrading biogas to renewable natural gas (RNG) requires a separation process to enhance the methane purity. There are four main technologies involved in the biogas to RNG upgrade: Membrane Separation, Pressure Swing Adsorption (PSA), Amine Scrubbing, and Water Wash (water scrubbing).[4] The size, shape, and charge properties of the CO_2 and CH_4 molecules are the primary factors driving the RNG upgrade process. *Note: The following information was compiled from "Basics of Biogas Upgrading" by Paul Greene on the Biocycle website written on January 11, 2018.*

1. Membrane Separation (Figure 2): "This technique uses polymeric membranes to separate the CO_2 from the methane in biogas while under high pressure. Membranes are produced in long, thin fibers with a hollow center core. Typical fibers are about 0.5 to 1 mm diameter. Compressed gas travels down the length of the fiber and CO_2, being a very ionically charged and smaller molecule, permeates through the porous membrane… To achieve greater than 98+ percent methane purity, two to three sequential stages of filtration are required: gas flows from stage to stage while increasing in purity."[5]
2. Pressure Swing Adsorption (PSA) (Figure 3): "PSA is a batch process utilizing several vessels running in parallel under pressure. The heart of the process is an adsorptive

media, similar to activated carbon, which separates gas molecules based on their molecular weight and size.

Pre-drying the gas ahead of the adsorbers to about 5°C is required to keep the humidity out of the vessels to maximize their performance as dry adsorbers… Carbon dioxide is preferentially adsorbed onto the media because it is a smaller molecule than methane and can permeate into the tiny pores in the carbon bed more easily and deeply. The methane goes through adsorber process columns relatively untouched while the CO_2 is held behind in the media. The adsorption process is reversible thus the CO_2 is eliminated during the regeneration cycle."

3. Amine Scrubbing (Figure 4): "Amine scrubbing system uses a two-step approach to upgrading biogas. The first step is adsorption followed by a second step of stripping or desorption... The amine portion of the scrubbing solvent molecule chemically reacts to the CO_2 in the biogas to retain it in solution. A common chemical deployed as the scrubbing solvent is MDEA (mono di-ethanol amine). The methane fraction of the biogas passes through the packed tower reactor untouched by the scrubbing chemical. High methane purities can be achieved in the recovered natural gas (>99.9 percent).

   In the second step, the scrubbing solution is heated to boiling to reverse the chemical reaction. The CO_2 in the fully packed stripper tower is disassociated from the scrubbing solution and discharged. High CO_2 purities in the off-gas can be achieved to accommodate potential for CO_2 reuse. The regenerated amine scrubbing solution is then cooled and reused back in the scrubbing tower in a closed loop system. Systems run at a relatively low operating pressure of about 0.5 to 3 psig. This low-pressure design affords equipment and operational savings as compared to systems that run at high pressure.

   Raw biogas H_2S levels over 300 ppm are recommended to be pretreated by any of the desulfurization techniques mentioned in the beginning of the article. Feed biogas is pressurized slightly ahead of the first step by a blower."

4. Water Wash (Figure 5): "Water wash systems are a two-stage process much like amine systems… The first step is a high-pressure reactor column that works in a counter current fashion. Chilled water flows downward and biogas flows upward under high pressure (150 psig). Soluble gases like CO_2 dissolve in the water, much like CO_2 stays completely dissolved in a typical carbonated soft drink container. The second tower serves as a depressurization tower where pressure is released from the solution and CO_2 degasses much like when pressure comes off an opened carbonated soft drink. Makeup water is added when needed. Blow-down water is purged from the system to maintain desired pH and water quality.

   This system is run as a wet process thus no predrying of the biogas is formally required but is recommended. Any H_2S found in the biogas is adsorbed in the process. The H_2S is purged from the system into the wastewater blow-down. Some suppliers, however, argue in favor of H_2S removal ahead of the system."

Figure 2: Membrane Gas Upgrading System

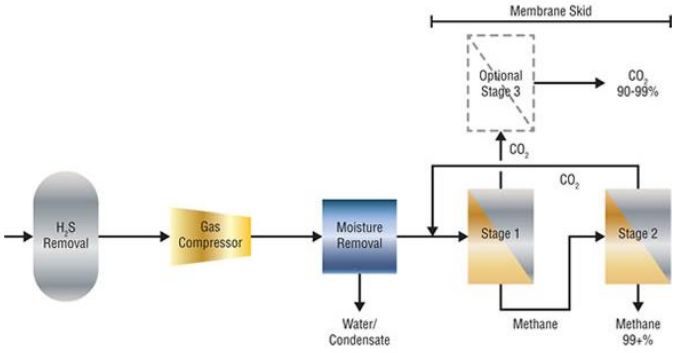


Figure 3: Process Flow Diagram

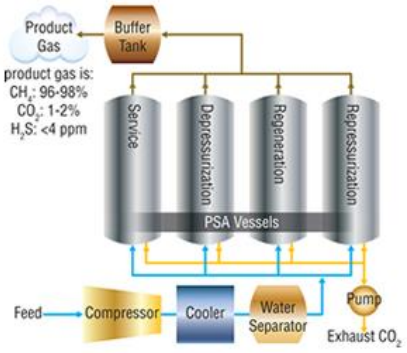


Figure 4: Amine Upgrading System Process Flow Diagram

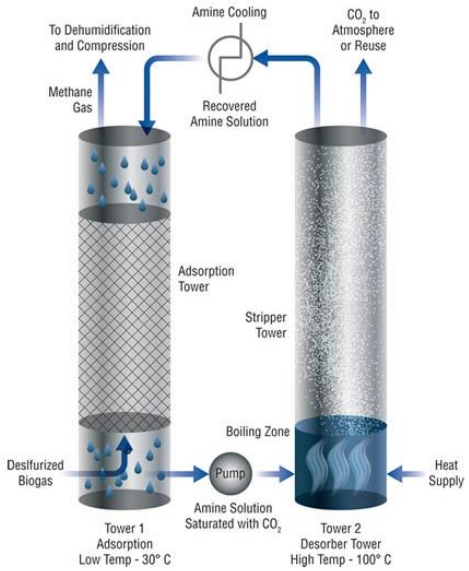
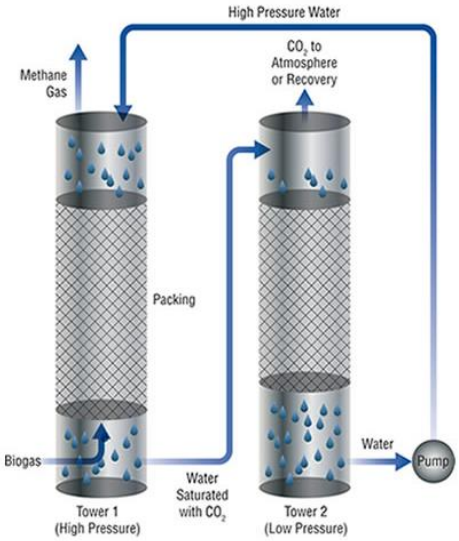


Figure 5: Water Wash System Flow Diagram



Source: From *Basics of Biogas Upgrading* by P. Greene, 2018, BioCycle (https://www.biocycle.net/basics-biogas-upgrading/#:~:text=Primary%20Upgrading%20Technologies,Wash%20(or%20water%20scrubbing).

Digestate-to-Fertilizer Manufacturing: Process and Technology

The second output created as a result of anaerobic digestion is called digestate. Digestate is a wet nutrient-rich mixture that is usually separated into a solid and a liquid, both of which can be used as fertilizer for crops.[6] The key to unlocking the value potential of digestate is in the drying process. Digestate coming out of the anaerobic digester can have a moisture content of up to 95%. If sent through a dewatering phase, this drops down to about an 80% moisture level.[7]

The separated liquids will also need to go through a sterilization phase in order to be reused. With a few additional inputs to balance the nutrient content, the liquid separated from the digestate can be further processed on-site into several different formulations and sold as a final liquid fertilizer product to local landowners directly from the GreenEdge® Renewables facility. The goal of this process is to minimize discharge of liquid into the sewer system and maximize resource utilization.

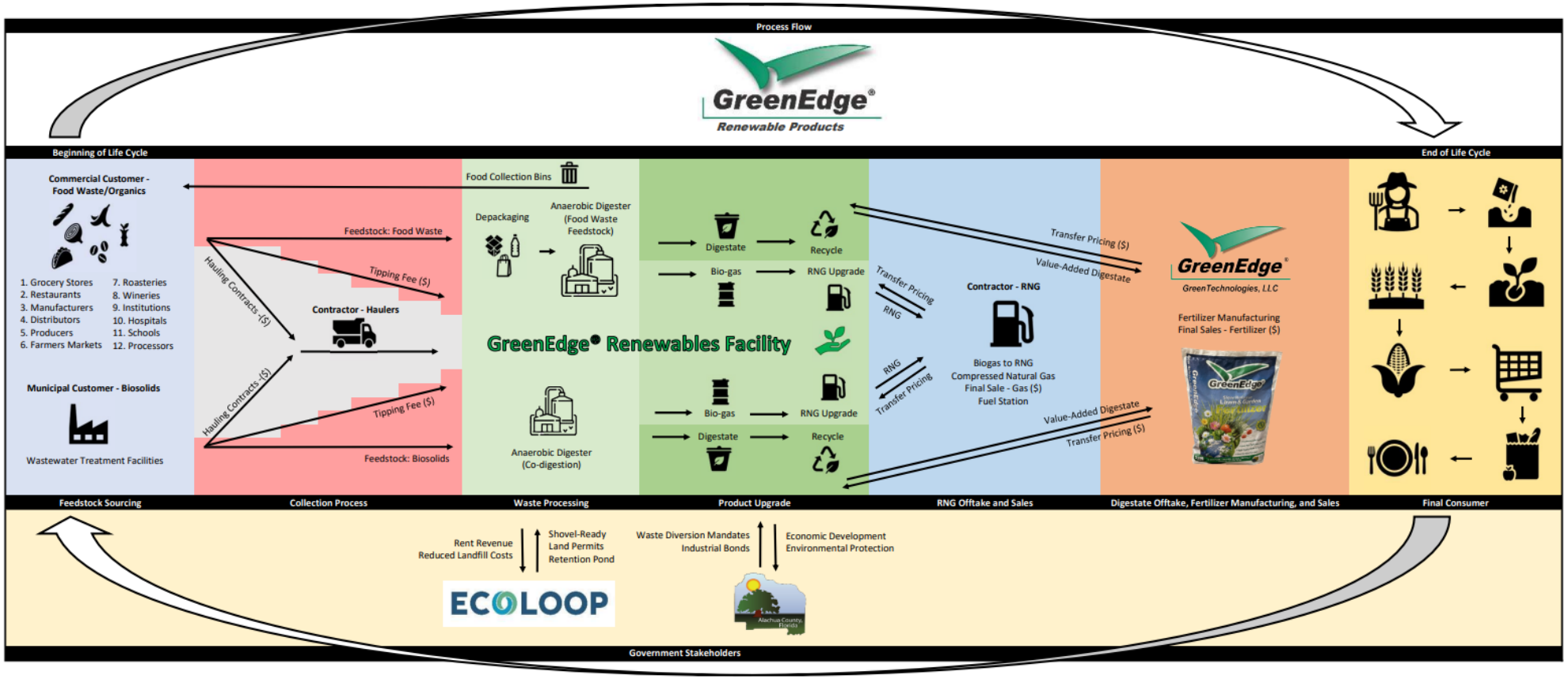
The remaining dried digestate can be transported to the existing GreenTechnologies' fertilizer manufacturing facility in Jacksonville, FL (Figure 6) for further value-add processing. GreenTechnologies runs a fully operational facility complete with screening, blending, and packaging equipment and holds several patents for the renewable enhanced-efficiency fertilizer production process. Products are licensed and sold under the brand name GreenEdge®. Examples of popular fertilizer formulations currently sold include GreenEdge® 6-3-0, GreenEdge® 7-7-7, GreenEdge® 8-2-1, and GreenEdge® 16-0-8. The formulations created from the EcoLoop facility material will depend on the nutrient content of the feedstock.

Figure 6: GreenTechnologies' Existing Renewable Fertilizer Manufacturing Facility

Source: Google Maps

All GreenEdge® fertilizers are slow release, incorporate organic materials, and include beneficial micronutrients such as iron, magnesium, and calcium. These properties become increasingly important as soil and plant health decline due to climate change and overuse. The slow release nature of GreenEdge® fertilizers also reduces water pollution due to nutrient run-off from overapplication of chemical nitrogen (N) and phosphorus (P) fertilizers.

Process Diagram



Note: The number and size of anaerobic digesters will be determined in the feasibility study stage. The purpose of the above diagram is only to provide a visual overview of the entire life cycle analysis.

Process Diagram Step-by-Step:

1. **Feedstock Sourcing**: There are two (2) potential sources of organic feedstock for RNG and enhanced-efficiency fertilizer production: 1) food waste and 2) biosolids from the wastewater treatment process. Food waste will be prioritized and there will be a focus to determine if there is sufficient food waste within a geographic footprint that makes logistical sense from an economic perspective. The emphasis will initially be on commercial customers such as meat processing facilities, restaurants, and grocery stores, that produce large quantities of food waste. Customers will generate food waste and separate out the feedstock into food waste collection bins. Whether bins will be provided by the GreenEdge® Renewables facility, purchased by the customer, or provided by the County will be determined during the feasibility study.
2. **Collection Process:** There will be two methods for receiving food waste.

    a. Third Party Collection: The first is a third party hauler and logistics handler who will be contracted to collect the food waste and swap out bins. The collection will occur weekly, though the number and size of the bins will vary based on customer needs. At this stage there will be a reasonable fee for the collection service to cover the cost of hauling and the bins.

    b. Customer Drop-Off: Alternatively, customers will have the option to haul their waste directly to the facility at no extra charge. If choosing this method, there will be a reduced tipping fee calculated by weight.

It is expected that the city and county ordinances requiring organics separation will promote sufficient participation.

Figure 7: Example of Organics Collection Facility

Source: From *Waste Not? Some States Are Sending Less Food to Landfills*, Stateline.org, July 8 2021, (https://stateline.org/2021/07/08/waste-not-some-states-are-sending-less-food-to-landfills/).

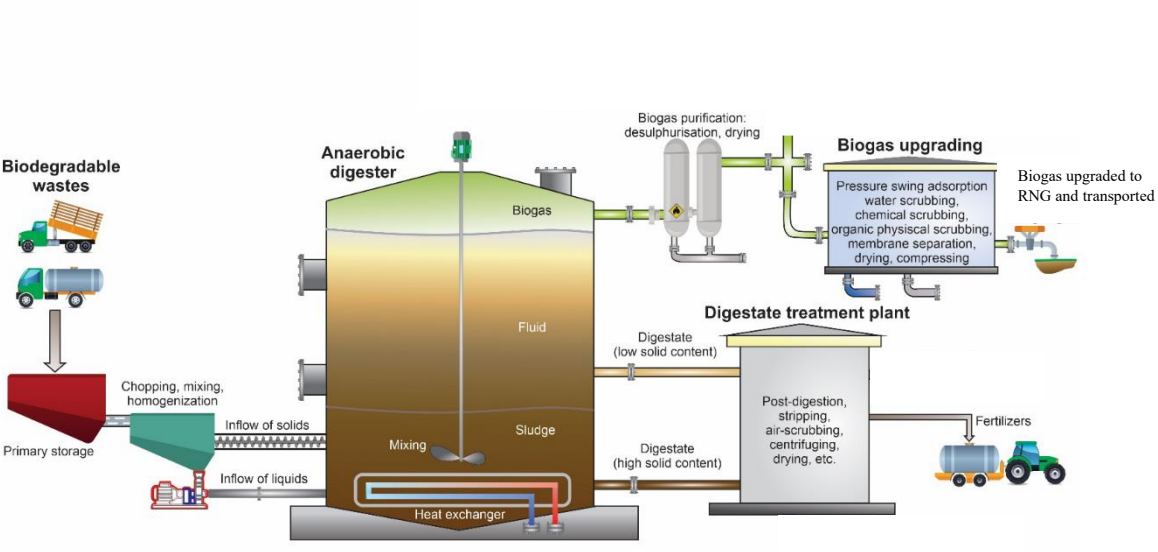
3. **Depackaging**: Once the feedstock arrives at the facility, waste will be sent through depackaging equipment to separate out any packaging materials. This process will also crush down the food waste into a digestible slurry that is ready for anaerobic digestion.

   There are several technologies available on the market for depackaging. Popular equipment options currently in the U.S. and Europe include the DODA BioSeparator, Doppstadt DSP 205 grinders, Dupps Mavitec shredders, Gemidan Ecogi wet pulping system, Haarslev hammermill equipment, Scott Turbo Separator, and Tiger Depackaging shredder/screening system.[8] The selection of depackaging equipment for this project will be decided during the feasibility study stage and with the guidance of experienced design and engineering consultants.

   The separated packaging will be sent to the Leveda Brown facility next door. Based on similar projects, this amount is expected to be minimal (approximately 2-5% of the total tonnage collected).[9]

4. **Anaerobic Digestion**: The slurry will then be fed directly into the anaerobic digester (Figure 8) where the organic material will be converted into biogas and digestate by micro-organisms (see Figure 1).

Figure 8: Organic Waste Processing through Anaerobic Digestion and Product Upgrade Process



Source: From *Current Status and Review of Waste-to-Biogas Conversion for Selected European Countries and Worldwide* by Zupancic et al., 2022, MDPI (https://www.mdpi.com/2071-1050/14/3/1823). Edited to fit this project.

5. **Product Upgrade**: In this stage, the biogas and digestate will be upgraded to create additional value for the end products. The biogas will be upgraded into RNG, and the digestate will be transformed into enhanced-efficiency organic fertilizers (Figure 9).

6. **Final Product Sales**: The finished products will be sold and distributed at transfer prices to partner owners for sale to end consumers.

Figure 9: GreenEdge® Biobased Enhanced Efficiency Fertilizers

Land and Capital Investment

The proposed project will require approximately 8-10 acres. This acreage is necessary to complete the through lanes for incoming vehicles, a receiving and weigh station, a separation area to remove food packaging, anaerobic digestors, natural gas upgrade station, a distribution area, administrative office, and fertilizer production and packaging building. The terms of the land lease or purchase are open for further discussion.

The approximate capital investment required to develop, design, construct, and commission the facility is based on quotes from a leading anaerobic digestion supplier (specific details are available upon request). The total capital investment is estimated to be between $30 - 45 million for a full-scale facility based on prior experience and discussions with equipment providers. However, the exact cost will be determined after the feasibility study period is completed as the total investment is dependent on the size of the operations and technical activities.

Considerations for anaerobic digestion to be determined during the feasibility study include:

- Type and quantity of feedstock available
- Temperature
- Moisture/solids content (wet or dry)
- Complexity (pretreatment options)
- Single feedstock per digester or co-digestion

Targeted Input / Output Material Streams

Overview

The target inputs for the proposed facility are organic waste streams*, including commercial food waste and municipal wastewater biosolids. Organic waste is the ideal input material for use in an anaerobic digestor due to the recoverable nutrient content and physical properties for biogas production. **Please note that this proposal excludes yard waste as an organic input due to incompatible physical characteristics*.

The output materials created from this project are digestate and biogas. In their crude form, these materials are less practical and derive little value. Therefore, this project also includes plans to dry the digestate for use in enhanced-efficiency fertilizer production and upgrade the biogas into renewable natural gas (RNG) to unlock the value potential of these by-products and produce commercially viable products for sale. In doing so, we can effectively "close the loop" on local organic materials.

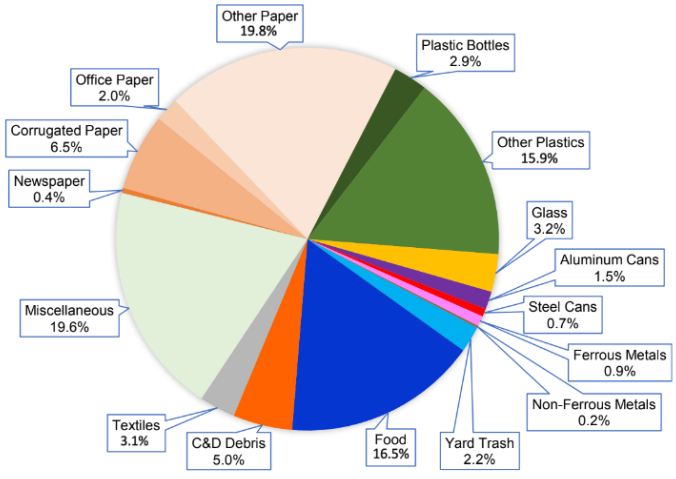
Target Inputs - Organic Materials

As mentioned above, this project targets two separate organic waste streams: food waste and biosolids. These will each require a different approach for sourcing, processing, and handling materials.

Food Waste. In the waste composition study conducted by the University of Florida in 2021, approximately 15-16% of the total waste generated in Alachua County is derived from food waste (about 100 tons per day).[10] This includes both residential and commercial waste, the breakdown of which is unknown. For this project, inputs will initially be targeted to commercial sources, but does not preclude residential sources from participating as logistics allow. At present, commercial food producers, manufacturers, and grocers are the ideal target for food waste collection and processing due to the high volumes of food waste generated daily.

In a study conducted by the Environmental Protection Agency (EPA) in 2019, food waste is generated from four main categories: food manufacturers/processors (38%), food retailers (12%), food service providers (25%), and households (25%).[11] For this project, we will assume these statistics also apply to

Figure 10: Alachua County ICI Waste Study Average Mass Percentages



Source: From *Alachua County 2020-2021 Waste Composition Study and Sustainable Materials Management Evaluation (Figure 10)* by Townsend et al., University of Florida, 2021.

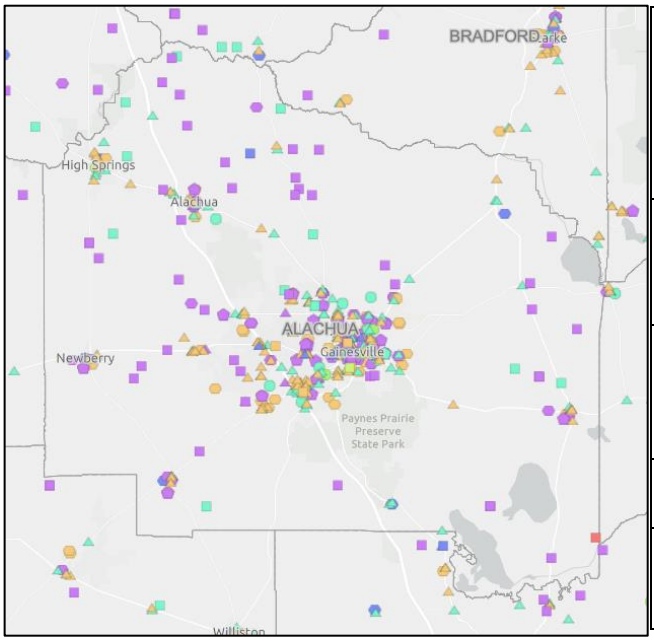
the organic waste mix produced in Alachua County. This project will target food manufacturers/processors, food retailers, and food service providers, equating to 75% of the total organics waste stream, or 75 tons per day. Of this amount, we assume we can capture two-thirds of this amount (or 50 tons per day) at full-scale operation.

The composition of this waste can vary based on the source. Example inputs include rotted produce, expired dairy products, oils/greases, and even meat processing byproducts. As described in the previous section, these materials will need to undergo a de-packaging stage prior to digestion to remove any plastics or non-organic materials that typically accompany food waste.

A sample of target food generation sites can also be derived from the Alachua County Foodshed Map on the UF Geoplan Center website.[12] **It is important to note that this is a sample and may not include all viable sources in Alachua County.*

Food generation sites from this study are separated into the following categories:

Figure 11: Alachua County Foodshed Map



Food Production – Square icons	Farms (38) – Purple Cottage Industries (1) – Blue Apiaries (11) - Green Roasteries (1) – Yellow Breweries (4) - Orange Wineries (1) - Red
Food Retail – Triangle icons	Local Restaurants (11) - Blue Grocery Stores (50+) - Orange Corner Stores (50+) - Green Farmers Markets (8) - Purple
Facilities – Circle icons	Processing (5) - Green Distribution (1) - Orange Commercial (1) - Blue Food Water Testing (7) - Green
Gardens – Pentagon icons	Gardens (33) - Purple Edible Landscapes (3) - Green
Food Assistance – Hexagon icons	Food Banks (28) - Purple After School Meals (36) - Orange Senior Meal Sites (5) - Blue

Source: From *Alachua County Foodshed Mapping* by E. Finlay & J. Hays, University of Florida (https://www.geoplan.ufl.edu/foodshed/).

Biosolids. Biosolids contain several key benefits including recyclable carbon, nitrogen, and phosphorus as well as beneficial micronutrients and organic matter necessary for soil and plant health. This could be another ideal waste stream source for the GreenEdge® Renewables facility to supplement open capacity. There are several wastewater facilities currently in operation in Alachua County. These operations are ideal targets for feedstock sourcing for co-digestion.

External Waste Streams. Currently, there are no plans to utilize waste streams generated outside of Alachua County. However, if there is open capacity at the GreenEdge® Renewables

facility, there could be an opportunity to supplement with outside waste streams should the occasion arise. In this scenario, waste generated in Alachua County will take precedence.

Outputs – Saleable Products

Biogas Converted into Renewable Natural Gas (RNG). Since the upgraded RNG is virtually indistinguishable from natural gas, the end customers are identical (homeowners, transportation, businesses, etc). RNG produced from this facility can be utilized both on-site for internal use and transferred into the Florida natural gas pipeline. While a pipeline does not currently exist at the EcoLoop property, the RNG can be transported via trucking.

In fact, for heavy-duty fleets, RNG may be the next step towards carbon reduction in the trucking industry. About 97% of heavy trucks run on diesel, a high emission fossil fuel.[13] However, business cases like UPS, Waste Management, and GFL have proven RNG to be an attractive alternative both in carbon *and* cost reduction. Mike Casteel, a retired UPS fleet procurement director believes "RNG is the only alternative to diesel that has the potential for significantly reducing carbon emissions while also meeting financial targets and operational demands… It's low-risk. No other technology is even close."[14] UPS ran a successful pilot program in the early 2010s and has since installed fueling stations and invested in heavy-duty natural gas trucks. Looking at the long-term, there is the potential to include an RNG fueling station for the large haulers coming through the Leveda Brown Transfer Station and EcoLoop.

Figure 12: University of Florida Natural Gas Vehicle

Source: From *SUPPORTING SUSTAINABLE WASTE MANAGEMENT AND ZERO LANDFILL WASTE* by UF Facility Services, (https://www.facilitiesservices.ufl.edu/departments/finance/recycling/).

In the U.S., natural gas is mostly used for generating electricity and heating.[15] According to the U.S. Energy Information Administration, the U.S. used about 32.31 trillion cubic feet of natural gas in 2022, or about 33% of the U.S. total primary energy consumption. Industries use natural gas as a feedstock for production and about 41% of the industrial sector's total end-use energy comes from natural gas. For the residential sector, natural gas accounts for 42% of total end-use energy consumption and "about 60% of U.S. homes use natural gas for space and water heating, cooking, and drying clothes".[16]

Figure 13: U.S. Natural Gas Consumption by Sector, 2022

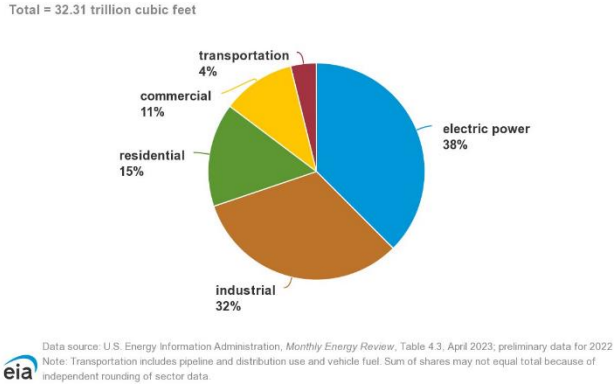
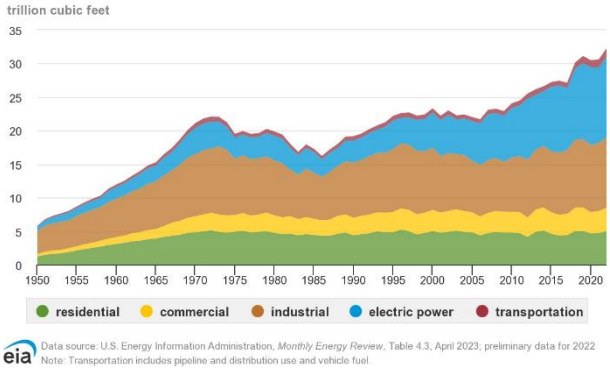


Figure 14: U.S. Natural Gas Consumption by Sector, 1950-2022



Lastly, while natural gas is used throughout the country, Texas (15.2%), California (6.8%), Louisiana (5.9%), Pennsylvania (5.7%), and Florida (5.0%) accounted for about 39% of total consumption in 2021.[17]

Digestate Converted into Enhanced-Efficiency Fertilizer. GreenTechnologies, LLC is an established enhanced-efficiency fertilizer manufacturer with experience in both dry and liquid fertilizer products. Liquid fertilizer products can be sold and distributed on-site to nearby customers. Due to the volume of such fertilizers, sales will be targeted towards local customers to reduce the financial and environmental cost of hauling. The dried digestate can also be sold and distributed on-site, but most of the material will likely be brought to the current GreenTechnologies' facility located on Highway 301 for further value-add activities. Additional processing can enhance the value of the fertilizer product and reduce the risk of environmental impacts due to nutrient imbalances.

Citrus producers in central Florida, such as Story Groves, large cattle ranchers, such as Deseret, and the wide range of agricultural producers served through our distribution partners have been avid users of GreenEdge® fertilizers. Additional production created from this project would allow GreenTechnologies to provide these existing customers with a higher volume of fertilizer in addition to enabling our organization to acquire other large customers and distribution partners as well. On a macro level, fertilizer accounts for about 20-36% of U.S. farm cash costs, depending on the crop.[18]

GT has the potential to significantly expand its existing customer base to surrounding agricultural producers. The counties adjacent to GreenTechnologies' manufacturing facility (Alachua, Baker, Bradford, Clay, Duval, Marion, Nassau, and Union) account for $306,722,000 in sales of crops and livestock. There is a total of 7,822 farms in these neighboring counties, and a combined 739,577 acres of farmland.[19] Table 1 below provides a breakdown of farms, acreage, and agricultural product sales for each county.

Table 1: Farmland in North Florida, 2017					
COUNTY	**AG SALES $**	**# OF FARMS**	**FARM ACRES**	**CROPS $**	**LIVESTOCK $**
Alachua	99,912,000	1,611	178,182	75,208,000	24,704,000
Baker	13,204,000	328	33,295	2,124,000	11,080,000
Bradford	13,087,000	490	58,841	3,574,000	9,513,000
Clay	5,456,000	361	NOT AVAILABLE	3,039,000	2,416,000
Duval	9,024,000	366	29,990	6,456,000	2,568,000
Marion	145,458,000	3,985	330,914	59,716,000	85,742,000
Nassau	12,878,000	373	54,588	703,000	12,175,000
Union	7,703,000	308	53,767	7,703,000	4,025,000

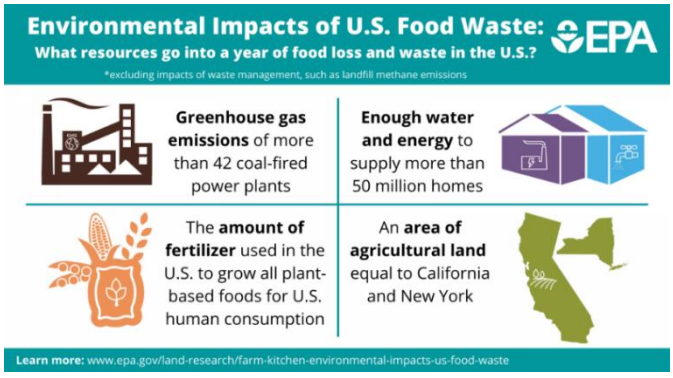
Source: From *2017 State and County Profiles – Florida* by the USDA NASS, 2017 (https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Florida/).

Environmental Impact

Waste Prevention, Recovery, and Reduction

Food Waste Recovery. This project is designed to target the 16% of organic waste generated in Alachua County that is currently landfilled at New River Regional Landfill in Raiford, FL.[20] The goal is to divert food waste from the source before it enters the waste stream and recycle the nutrients and methane into saleable products. In a 2021 study conducted by the Environmental Protection Agency (EPA), food waste was found to be the "single most common material landfilled and incinerated in the U.S."[21] As noted in the Targeted Input / Output Material Streams section, the assumption for this project is 50 tons of organic/food waste per day will be captured at the GreenEdge® Renewables facility. However, this metric is only an estimate and exact quantities will be determined during the feasibility study period.

Figure 15: Environmental Impacts of U.S. Food Waste



Measurements. Using the Anaerobic Digestion Screening Tool from the EPA website,[22] we can estimate the recovered nutrient values, carbon content, recovered methane, and emissions reductions based on the quantity and type of inputs. For this project, we enter data with the following assumptions:

Example Analysis (Not Final):

1. Is the planned AD a wet or dry system? Wet
2. What will the reactor temperature be? Mesophilic
3. Will the system installation include post-digestion dewatering equipment? Yes
4. If "Yes", what is the solid capture efficiency of the dewatering equipment? 90%
5. Feedstock:
    a. Mixed Food Waste with Non-Veg – 50 metric tons/day
    b. Biosolids – 100 metric tons/day

For measuring the environmental impact of this project, we also use the default feedstock characteristics (**Table 2**) as provided by the screening tool with the following results (**Table 3**):

Table 2: Input – Default Feedstock Characteristics

Feedstock Characteristics	Mixed Food Waste with Non-Veg	Biosolids
Moisture Content	57%	89%
Total Solids	43%	11%
Volatile Solids	41%	6%
Inert Material and Ash	2%	5%
Nitrogen Content	1%	2%
Carbon Content	51.81%	31.67%
Proteins	18%	15%
Fats	19%	25%
Sugars and Starches	59%	25%
Feedstock Totals (kg/day)	50,000	100,000

Table 3: Output – Biogas, Methane, and Digestate

Biogas Production - The estimated low and high production values use calibration factors from actual observations that represent the 25th and 75th percentile values of the ratio between measured and modeled data. These values are used to adjust the maximum potential biogas generation values to estimate the likely biogas generation potential values.	**Estimated Value (low)**	**Estimated Value (high)**	**Theoretical Maximum Potential**	**Unit**
Annual Biogas Production	2,294,338	4,180,688	5,723,691	m3/year
Annual Methane Production	1,250,414	2,278,475	3,119,412	m3/year
Digestate Production		**Value**		**Unit**
Total Non- Biodegradable Solids		2,158,488		kg/year
Remaining Volatile Solids		7,621,967		kg/year
Digester Solids		9,823,343		kg/year
Dry Sludge		8,841,009		kg/year
Liquid Effluent		982,334		kg/year
Energy Recovery Options - Each energy recovery option is an "or" estimate (i.e., the plant will not be capable of producing both X kWh of electricity and Y m3/year natural gas, but is capable of producing either X kWh of electricity hours or Y m3/year of natural gas).		**Value**		**Unit**
Electricity Production (cleaned biogas to natural gas quality)		16,958		MWh
Electricity Production (biogas only)		11,469		MWh
Renewable Natural Gas (RNG) Production		1,764,444		m3/year
Cooking Gas Potential		29,566		homes/year
Home Heating Potential		22,175		homes/year

RNG – Methane Emissions Reduction and Recapture

Methane Recapture. As shown in the **Table 3** results, the feedstocks processed at the GreenEdge® Renewables facility would produce between 2,294,338 – 4,180,688 cubic meters of biogas each year through captured methane production. According to the EPA website, "Methane has a 12-year lifetime in the atmosphere and traps 28-36 times more heat than carbon dioxide over a 100 year time scale, resulting in a stronger influence on global warming. Capturing methane and using it as an energy source has a positive impact on the environment, as it avoids methane emissions and displaces conventional fossil fuels."[23]

Renewable Natural Gas. In order to fully utilize the biogas, we can upgrade it into renewable natural gas (RNG) by removing the water vapor, carbon dioxide, hydrogen sulfide, and other impurities in order to increase the methane content. The resulting RNG can then be injected into existing natural gas pipelines and used as a substitute for natural gas. As stated on the EPA website, "RNG is essentially indistinguishable from natural gas but is derived from biological materials rather than from fossil fuel deposits. RNG can be used for thermal applications, electricity generation, bio-plastic feedstock or vehicle fuel." [24]

Using the above parameters as an example, approximately 1,764,444 cubic meters of Renewable Natural Gas (RNG) could be generated and serve as a replacement for resource-intensive fossil fuels. If the average U.S. household uses 2,700 cubic meters of natural gas each year, then we could power over 650 homes annually with RNG produced from the GreenEdge® Renewables facility. Not only do we divert the methane from landfills but also significantly reduce the need for mining and long-distance transportation of these resources.

Enhanced Efficiency Fertilizer – Nutrient Recapture and Recycling

Enhanced Efficiency Fertilizer Production. GreenTechnologies was founded on the concept of nutrient recycling and has been a trailblazer in developing and marketing innovative biosolids and biobased fertilizer products for agricultural producers. Nearly all of GreenTechnologies' current fertilizer products are made through enhancing and recycling biosolids, a renewable nutrient source to produce value added biobased fertilizer products. With the addition of this project, we can produce additional GreenEdge® enhanced-efficiency fertilizers utilizing the digestate from the anaerobic digesters. Using our current parameters in **Table 2** as an example, the resulting dry sludge digestate produced each year is equivalent to an estimated 9,745 tons of organic fertilizer. *Note: This number is only an example and exact quantities will be determined during the feasibility study.*

In addition, in a study conducted by the European Biogas Association (EBA) in 2015, it was found that "1 tonne of artificial fertiliser replaced with digestate saves 1 tonne of oil, 108 tonnes of water and 7 tonnes of CO_2 emissions".[25] If we apply these statistics to our example of 10,000 tons of digestate, this equates to 10,000 tons of oil, 1,080,000 tons of water, and 70,000 tons of CO_2 emissions each year.

Nutrient Recovery. Conventional, synthetic fertilizers are typically the most used in agriculture due to a higher nutrient content, however, the production of these fertilizers requires considerable energy use from mining and leaves a large carbon footprint. Due to high solubility, a significant portion of the nutrients from conventional fertilizers are often lost to the surrounding environment causing end users to incur higher operational costs and economic losses associated with more frequent fertilizer application. Conventional fertilizers can also create environmental problems through higher levels of nutrient pollution.

Organic, biobased, enhanced efficiency fertilizers provide a sustainable alternative to traditional synthetic fertilizers. Through the development, manufacturing, and distribution of climate-smart enhanced efficiency fertilizers, we can accomplish increased food production while at the same time reducing the environmental impact of large-scale agriculture.

Up to 100% of Nitrogen, Phosphorus, and Carbon in GreenEdge® products comes from recovered organic sources reducing the reliance on nutrients that are traditionally mined. GreenEdge® fertilizers facilitate carbon sequestration by returning carbon to the soil and decreasing greenhouse gas emissions associated with landfilling, incineration, and other biosolids disposal methods.

Soil Health. Organic material used in every GreenEdge® product also contains micronutrients like Calcium, Iron and Magnesium. With each application, these micronutrients are recycled back into the soil. Micronutrients promote essential plant processes and growth, which translates into nutrient-rich food for animals and humans.[26] The high carbon content of biobased fertilizers also improves soil health reducing the vulnerability of crops to climate change related weather events, such as droughts and heavy rainfall.[27]

Greenhouse Gas Benefits. Additionally, this project will use lbs. of Nitrogen and BTUs as a unit of measurement to report and track the greenhouse gas benefits anticipated from using enhanced-efficiency fertilizer. The reporting and tracking will consist of a comparison of Urea

fertilizer with 46% Nitrogen compared to GreenEdge® fertilizer with 6% Nitrogen as an example.

- *Per Ton of Urea***.** Each ton of Urea requires approximately 22 MMbtu of natural gas to produce. For each ton of Urea, 46% is comprised of Nitrogen. Therefore, the total BTU expenditure from the Nitrogen in Urea fertilizer is equal to 10,120,000 BTUs per ton, or 920 lbs.
- *Per Ton of GreenEdge®.* For example, at 6% Nitrogen per ton, each ton of GreenEdge® comprises of only 120 lbs. of Nitrogen. By replacing each ton of Urea fertilizer with GreenEdge® EEF, a total of 800 lbs. of Nitrogen and 8,800,000 BTUs are saved per ton.
- *Annually*. If 10,000 tons of enhanced-efficiency fertilizer are expected to be produced each year because of this project and if each ton replaces one ton of Urea fertilizer, then a total of 8 million lbs. of Nitrogen and 88 billion BTUs would be avoided annually.

This is equivalent to emissions from 705,000 gallons of gasoline consumed, 7,018,137 lbs of coal burned, 790 homes' energy use for one year, and 16,061,492 miles driven by an average gasoline-powered passenger vehicle. Annual carbon sequestration is equivalent to 103,598 tree seedlings grown for 10 years, 7,472 acres of U.S. forests in one year, and 41.5 acres of U.S. forests preserved from conversion to cropland in one year.[28]

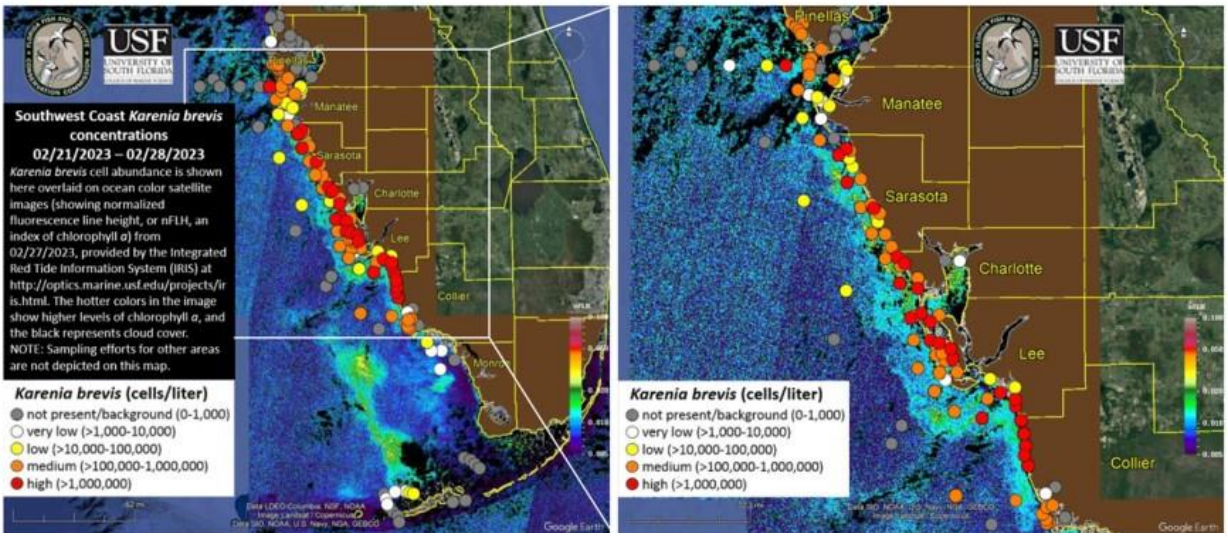
Water Pollution. Nutrient imbalances and overapplication of chemical fertilizers to land often causes harmful nutrient pollution in local waterways. For example, high levels of phosphorus can disperse as a pollutant through erosion, leaching, and accumulation in soil pools. Excessive nitrogen and phosphorus in bodies of water can cause algae bloom which dominates other resources and causes plants to die. In Florida, nutrient pollution contributes to the harmful effects of "Red Tide", an algal bloom capable of killing fish, birds, other marine animals, and causing health problems in humans[29]. By coupling organic material landfill diversion with enhanced

efficiency fertilizer use, we can significantly decrease the effects of nutrient pollution impacting our Florida bodies of water and protect the local ecosystems.

Figure 16: Red Tide in Madeira Beach, FL (2021)

Source: From *Florida's Red Tides Are Getting Worse and May Be Hard to Control Because of Climate Change* by A. Azhar, Inside Climate News, 2022 (https://insideclimatenews.org/news/19012022/florida-red-tide-

Figure 17: Red Tide Hotspots - Spring 2023



Source: From *Red tide is getting worse along the Gulf beaches* by S. Newborn, Health News Florida, March 2, 2023 (https://health.wusf.usf.edu/health-news-florida/2023-03-02/red-tide-is-getting-worse-along-the-gulf-beaches).

Risk Allocation

Business Model

The business model includes three sources of revenue generation:

1. **Tipping/Collection Fees**: This revenue stream will be priced to cover the cost of collection, logistics, and hauling. As this is a service to supplement trash collection and landfilling, the fees will be collected at the consumer and/or municipality level and priced to be competitive with alternative disposal methods. It is also important to note that the fees generated at this level will be circulated back into the local economy through jobs and local hauling and contracting services.
2. **Enhanced Efficiency Fertilizer Sales**: The dried digestate will be utilized by GreenTechnologies for use at the existing fertilizer production facility in Jacksonville, FL. This will ensure a disposal method for the digestate that is both environmentally friendly and revenue-generating. End product fertilizer sales will be the sole responsibility of GreenTechnologies. As such, any additional revenue generated from final product sales will be collected by GreenTechnologies. Any strategic transfer price will be determined during the feasibility study and will cover a share of the processing and operating costs. The proportion of cost sharing will be based on the value of the product being transferred out of the facility.
3. **RNG Sales**: Like the digestate, the upgraded RNG will be purchased at an agreed-upon price by the gas offtake partner for use in their RNG. End product RNG sales will be the sole responsibility of the gas offtake partner. As such, any additional revenue generated from final product sales will be collected by the gas offtake partner. The strategic transfer price will be determined during the feasibility study and will cover a share of the processing and operating costs. The proportion of cost sharing will be based on the value of the end product being transferred out of the facility.

Risk Mitigation

Risk is mitigated in several ways throughout the business model. First, this project proposes to use established and proven technologies. The equipment required to complete each stage is well-documented and readily available. Grants will be utilized where possible to help fund the cost of the equipment. It is indeterminable at this stage if equipment will be under lease or ownership. However, this will be determined during the feasibility stage to choose the option with the lowest possible risk to the overall project.

Second, a minimum revenue could be guaranteed through transfer pricing between the entity and partner owners. This creates a mutually beneficial relationship in which each entity can divert resources and focus to its assigned area of expertise. In this case, the facility is responsible for sourcing and processing, GreenTechnologies is responsible for the fertilizer production and sales, and the gas offtake partner is responsible for the RNG and sales. This operating structure spreads

the risk across all three entities proportional to the derived value received as a result of operating activities.

Additionally, during our initial research phase, we discovered that anaerobic digestion projects often fail because there is no plan for the digestate. In many cases, digestate is regarded as a byproduct with little value or use compared to the revenue generated from the RNG. In this project, we see digestate as a valuable material for fertilizer production. The GreenEdge® brand is well-known and established among customers. Our motivation for pursuing this project is to diversify our feedstock to include food waste digestate to create more fertilizer products and formulations to satisfy customer needs. Research is currently being conducted at GreenTechnologies to turn digestate into high-quality organic fertilizer and final results will be utilized in the feasibility study. Our company houses decades of knowledge and experience in regard to nutrient recapture and reuse, and this knowledge will be applied to the reuse of the digestate.

Third, there is the risk of not having enough food waste to support a financially viable project, especially in the beginning of the facility's operations. To mitigate this risk, the facility will also be designed with the capability to receive biosolids feedstock from local sources. This is a consistent and consolidated feedstock that can be used to generate revenue to expand the project to full-scale. At the moment, it is indeterminable if this project will use co-digestion practices or separate digesters. A feasibility study is required to determine the most economic course of action.

Lastly, this timely project aligns with the County's waste diversion goals and the City of Gainesville's Zero Waste Initiatives. With the support of local laws and ordinances, the risk of waste generators not diverting organics is greatly minimized.

Design, Construction, and Operation

GreenTechnologies has discussed the proposed plans with a well-known and established architecture, engineering, and construction firm. This firm has worked closely on many projects across the country similar to the one proposed in this application. They have experience with all sizes and equipment types and will serve as consultants throughout the design, construction, testing, and operating phases. This firm has also connected GreenTechnologies to several of their key contacts who have extensive experience in this area, including sourcing feedstock, operating, and financing. These valuable resources will be utilized throughout the project period.

Capital Requirements

The estimated capital cost of this project at full-scale is between $30M and $50M for all design, procurement, construction, and permitting. However, to reduce risk, we plan to use a phase-in approach to scale up production and minimize unnecessary capital losses.

1. **Feasibility Study.** The phase-in approach begins with a feasibility study to determine logistical and financial viability first. It is estimated that the feasibility phase will take 4-6 months to complete. GT will conduct a feasibility study which includes but is not limited to the following items:

a. Feedstock availability, sourcing, and characteristics
b. Logistics and delivery
c. Anaerobic digestor specifications
d. Financial requirements
e. Gas and digestate production

Upon completion of the feasibility study, GT will meet with the County and share the findings.

2. **Full-Scale Design and Planning.** If the feasibility study is deemed a success, GT will then move on to the commercial design and planning phase. It is estimated that this phase will take 6-12 months to complete. At this stage, GT will enter into a mutually agreed upon lease agreement for the EcoLoop property.
3. **Full-Scale Construction and Procurement.** Once satisfied with the final layout, we will commence the full-scale construction and procurement phase.
4. **Full-Scale Operation.** At this stage, the project development is complete and the GreenEdge® Renewables facility will be fully operational. GT expects completion to occur in 2026.
5.

Economic Impact

Direct Job Creation

The most direct economic impact resulting from the GreenEdge® Renewables project is in job creation. In order to support the level of production and sales projected at this facility, we estimate a total staff of 23 new full and part-time jobs at full-scale capacity:

1. Operations – 8
2. Engineering - 2
3. Drivers/Contract Haulers – 3
4. Research and Development – 2
5. Customer Relations - 1
6. Office and Administration – 2
7. Sales and Marketing – 2
8. Student Interns/Apprentices* – 3

Wages will range from $18 - $25 per hour for hourly employees, and salaries will range from $50,000 - $150,000, depending on experience and job duties. In addition, GreenEdge® Renewables offers a competitive benefits package with 15 days of paid time off, health insurance, annual bonus and salary increase opportunities, monthly recognition events, and a 401(k) matching plan. Jobs added will be scaled up throughout each phase to support the relevant level of operations.

*Education and employee development is an important value for the company. Once operational, a specialized internship and/or apprenticeship program will also be implemented alongside the

project to help students develop technical skills. Students may be selected from local high schools and/or colleges (Santa Fe or University of Florida) depending on the roles available.

Indirect Job Creation

In addition to the direct hires, the project development phase itself will contribute to the local economy through construction and engineering activities. A project of this nature will require significant investment, most of which will stay within the local economy. Using multipliers from the Economic Policy Institute in 2019, we can estimate that for every one direct job created, 5.14 indirect jobs are created in tandem through supplier and induced jobs. [30] This equates to approximately 118 additional jobs created indirectly.

As the project period begins, there will be additional job creation through increased hauling activities as we target new feedstock sources (restaurants, grocery stores, etc) that previously did not require separate transportation. Distribution and logistics occur both at the front-end (feedstock sourcing) and the back end (final product to customer).

Additionally, the co-owning companies of the GreenEdge® Renewables facility have localized activities outside of this project that will have an economic impact on the local and regional communities. GreenTechnologies has offices in both Gainesville and Jacksonville, FL that will grow alongside this project. In particular, the digestate sent to the fertilizer production plant will significantly increase GreenTechnologies' current production volumes causing a need for additional local salespeople, operators, drivers, and more.

Cross-Industrial Partners

This organic waste to value-added products project represents a cross-industry collaboration across the entire value chain. This requires partnership from several key players in food waste management, logistics, utilities, manufacturing, and sales. GreenTechnologies has cultivated these strategic partnerships to ensure each step is handled by experts in each respective field in order to minimize risk.

1. Food waste – food processors, institutions, supermarkets, restaurants, etc
2. Wastewater treatment facilities – municipalities, utilities
3. Logistics and collection – haulers and sourcing experts
4. Anaerobic digestion – engineering/design consultants, operation/maintenance partners
5. Biogas/RNG – utilities and/or RNG gas producers
6. Digestate/Fertilizer – agricultural producers, fertilizer industry

Waste Issues to Economic Opportunities

Currently most organic waste in Alachua County is not separated and is subsequently landfilled with the rest of the garbage. This results in avoidable tipping fees and larger quantities hauled out of the county to the nearby landfill costing the County $30 per ton. With the addition of organics separation, on-site processing, and value-add processes, we can both reduce this logistical cost to the County *and* create saleable products that benefit local farmers, homeowners, and establishments. If we assume 50 tons per day can eventually be diverted from the landfill, this equates to approximately $547,500 of savings each year using present day rates.

Research and Development

Research, development, and innovation is a core part of GreenTechnologies' business operations. Our company is always looking for new technologies to stay ahead of the customer and market needs. GreenTechnologies has applied to several USDA Small Business Innovation and Research grants and has been awarded both a Phase I and Phase II commercialization grant for new patented technology. We are actively applying to the new round of research grants through the EPA and USDA to expand the application and use of this technology to additional feedstocks.

Outside of grants, GreenTechnologies works with UF Chemistry Professor and materials scientist, Dr. Daniel Talham to test the effectiveness of GreenEdge technology in the lab prior to commercialization. Dr. Talham has been an invaluable resource to the company and has expressed interest in continuing to work with GreenTechnologies in development of digestate products.

GreenTechnologies representatives also sit on the Board for a new anaerobic digestion study designed to analyze the risks of anaerobic digestion, mitigation strategies, and predictive modeling for food waste in Alachua County.

GreenTechnologies also rents office space at the UF Innovate business incubator located in Gainesville, FL. This location is in close proximity to the UF lab and provides direct access to the student talent coming out of the University.

Lastly, GreenTechnologies has contracted out third party studies at the University of North Carolina to conduct field tests for different GreenEdge® formulations. These field tests support our research activities and will be continued with new products created from the digestate resulting from this project.

Local, Regional, and Global Impact

Addressing the Needs of Regional Manufacturers. A core benefit of this project begins at the front-end of the process. On June 1, 2023, the City of Gainesville released Ordinance No. 210626, Ch. 27, Div. 7 requiring all "commercial establishments that generate one cubic yard of food waste or more per week" to "separate food waste from the waste stream and collect food waste in containers that are separate from garbage and recovered materials." Starting on January 1, 2024, this ordinance will also apply to businesses over 4,500 sq ft where the kitchen occupies over 1,000 sq ft.

For companies that fall under this umbrella, there are few options currently available for food waste disposal. This project will provide an alternative to current disposal methods and will work with local food waste producers to determine the most efficient means of collection to minimize economic loss.

Local Partners. Target relationships on the local level include grocery stores, restaurants, and institutions with large quantities of food waste. We will additionally work with local hauling companies to coordinate and contract logistics for pick-up and drop-off services. Lastly,

GreenEdge® fertilizer is sold in many local stores throughout Alachua County and we intend to expand this distributor partnership alongside this project.

Regional Partners. Regional partners include utilities, wastewater treatment facilities, and customers located in Northeast Florida.

Global Partners. Outputs from the GreenEdge® Renewables facility will be distributed to strategic locations locally, regionally, and globally. The RNG developed from this project will be piped into Florida natural gas pipelines and/or injected into trucks for hauling. The enhanced efficiency fertilizer products are distributed across Florida, the United States, and Central and South America.

Experience, Finances, and Qualifications

GreenTechnologies, LLC

GreenTechnologies, LLC develops processes and technologies for the production of biobased fertilizers utilizing recycled nutrients. GreenTechnologies was founded by Dr. Amir Varshovi and Marla K. Buchanan, Esq. in 1999, and the primary GT facility is located in the rural area outside of Jackonville, FL. After completing his PhD in soil and water science at the University of Florida, Dr. Varshovi focused on opportunities to recycle low cost, nutrient rich byproducts from wastewater into high performance and environmentally sustainable fertilizer products. GreenTechnologies' primary objectives are to provide a sustainable alternative to quick-release and chemical-based fertilizers, expand production capabilities, and increase market share.

GT has an existing fertilizer manufacturing and packaging facility located in the rural area of Clay County, Florida where it develops, manufactures, and markets enhanced efficiency biobased fertilizers for commercial, residential, and agricultural use. GT also has a business development office located in Gainesville, FL.

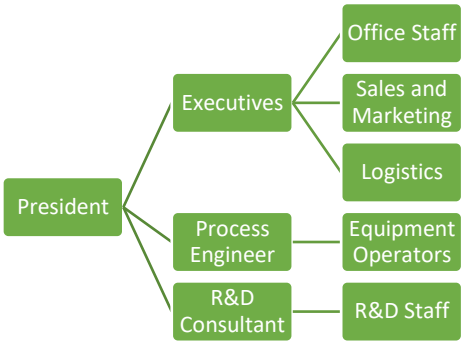
The company's patented line of enhanced slow-release bio-based fertilizers is branded and marketed under the name GreenEdge®. GT has over 20 years of experience in manufacturing, marketing, and distributing these climate-smart commodities through distributors and retailers. All GreenEdge® fertilizers are USDA Certified Bio-Based Products.

GT currently serves about a dozen small and underserved farmers within a 50-mile radius of the facility. These farmers include veteran, minority, low-income, and new farmers, and they typically own land ranging from 10-100 acres.

GreenTechnologies' core competencies come from technical expertise in fertilizer product development and manufacturing and commercial experience in sales and distribution. The company has utilized its technical expertise to produce a patented line of slow-release, organic fertilizers that out-perform other organic and biosolids based products and offers significant cost savings to customers. GreenTechnologies has branded and marketed its current line of slow-release, biobased fertilizers under the name GreenEdge®. The company currently holds three patents for its technology.

GreenTechnologies has employed 17 to 20 employees annually over the past five years with its workforce composed of four executives, a sales staff of three, administrative staff of three, and the remaining workforce employed in manufacturing and logistics. Figure 18 provides an organizational chart of the current structure.

Figure 18: Organization Chart



GreenEdge® fertilizers are currently sold domestically and internationally and include a wide range of custom formulas made for agriculture, lawn and landscape, retail, and professional turf markets. Over the last five years, GT's sales revenue has grown 52% with an average annual growth rate of 15%.

The GreenTechnologies' vision is to continue developing new technologies for the commercialization of sustainable fertilizers. The company intends to expand into new and existing markets through product development, licensing, partnerships, and the expansion of consumer sales.

Lastly, for over 20 years, GreenTechnologies has been recognized both locally and nationally for our commitment to sustainability, technology, and innovation. Awards and recognition have been granted from the following organizations: the USDA, Gator100, the U.S. Small Business Administration, Inc. 5000, the U.S. Commercial Association, the Environmental Protection Agency, Arizona State's Sustainable Earth, and the Florida Water Environment Association.

Figure 19: Awarding Organizations

Key Team Personnel

Figure 20: Management Team

Dr. Amir Varshovi, the Founder and CEO of Greentechnologies is a former senior research scientist at the University of Florida's Department of Soil and Water Science, founded GreenTechnologies in 1999. He received his Bachelor of Science in Chemistry from the University of South Florida in 1974, his master's degree in Soil and Water Science in 1991 from the University of Florida and his PhD in Environmental Soil and Water Science from the University of Florida in 1995. He also completed a program in Industrial Fermentation Technology from Massachusetts Institute of Technologies (MIT) in 1997. Since the organization's founding, Dr. Varshovi has leveraged his technical expertise and unrivaled commitment to guide GreenTechnologies to the pinnacle of success during his tenure as Chief Executive Officer. In recognition of his achievements and commitment to excellence, Dr. Varshovi received the SBA award for the state of Florida's Small Businessperson of the Year for 2014. GreenTechnologies was also the recipient of the EPA's Administrator Award for Outstanding Accomplishments by a Small Business Contractor in 2018.

Prior to founding GreenTechnologies, Dr. Varshovi devoted his talents and time to academia. While earning his Ph.D. in Soil and Water Science from the University of Florida, Dr. Varshovi worked as a research scientist evaluating commercial fertilizers for efficacy and environmental impact. He studied fertilizer components, their effects on healthy plant growth, and their effects on the surrounding environment. Dr. Varshovi discovered that many of these components are produced outside the United States and realized the need for environmentally friendly fertilizer that utilizes renewable resources available locally. Dr. Varshovi began developing processes of nutrient recycling, finding sustainable alternative sources for the nutrients plants need. Dr. Varshovi holds two patents in the production of enhanced efficiency and slow release organic fertilizers from renewable resources.

Ms. Marla K. Buchanan, JD, is the Chief Operating Officer and General Counsel for GreenTechnologies, LLC, a technology and manufacturing company that develops processes and products from the water treatment process. One of the founding partners of GreenTechnologies, Ms. Buchanan has played an instrumental role in the organization's success and growth. Through her position, Ms. Buchanan sustains and improves upon the efficient and effective operations of GreenTechnologies, while also identifying, planning, and implementing large-scale projects for the organization's long-term strategy and expansion. Prior to joining GreenTechnologies full-time, Ms. Buchanan was a shareholder at the prestigious Jacksonville law firm of Rogers Towers, P.A., where she practiced law for fourteen years. In recognition of her hard work and consummate professionalism, Ms. Buchanan received an AV Preeminent Rating from Martindale-Hubbell, which is a distinction reserved for only the most successful and dedicated attorneys. Ms. Buchanan received her Juris Doctorate from the University of Florida's Levin College of Law and is an active member of the Florida Bar association. Ms. Buchanan has accumulated numerous accolades during her career including the pro bono Attorney Award from Jacksonville Legal Aid. In addition to her notable accomplishments and laudable performance in the field of law, Ms. Buchanan has been a lecturer for the National Business Institute and the Florida Bar and has also given frequent lectures to Financial Planners, Accountants and Business Valuators.

Alexander Varshovi, MBA, a graduate of the University of North Florida's Master of Business Administration Program, is a valued and distinguished employee of GreenTechnologies. While working towards the completion of his graduate studies, Mr. Varshovi worked with GreenTechnologies in various capacities including but not limited to financial analysis, managerial accounting, and marketing. Alexander Varshovi has exploited his business knowledge to successfully serve as a financial analyst in capital budgeting projects, and to generate financial reports for internal performance assessments. In addition to his work in financial analysis and managerial accounting, Alexander Varshovi has been a successful leader in several of the company's marketing projects, such as the development of e-commerce channels, redesigning the company's website, and establishing an effective social media presence.

Contessa Hutchins, MA, is a graduate of the University of Florida with a bachelor's and master's degree in accounting. Ms. Hutchins worked with a Big Four public accounting firm prior to joining GreenTechnologies full-time as a Business Development Manager. Her role includes developing partner relationships, acquiring capital funding, internal restructuring, and financial analysis. She has contributed to several successful grant applications and hiring campaigns. Ms. Hutchins has completed all four sections of the CPA exam and is in the process of finalizing her license for the state of Florida.

Victor Santamarina. Mr. Santamarina currently serves as GreenTechnologies' Chemical and Process Engineer. Mr. Santamarina has a Bachelor of Science in Chemical Engineering and is a S-4 Public Wastewater Licensed Operator. Mr. Santamarina has 37 years of experience as an engineer in the water and wastewater industry. He started his career as a Process Control Engineer for the Middlesex County Utilities Authority and worked his way up to Plant Superintendent of New Jersey's second largest wastewater treatment plant where he managed

over 120 employees and was responsible for a budget of $83 Million Dollars. Mr. Santamarina managed numerous capital improvement projects during his tenure at Middlesex County Utilities Authority before retiring in 2019. Since that time, he has worked as a consultant and Managing Engineer in private industry. Mr. Santamarina is recognized as an expert and leader in his field. He has authored several technical papers which have been published by industry leading sources. He is a member of the Water Environment Federation and contributed significantly to GreenTechnologies' operations.

Research Consultant

Dr. Daniel Talham for Chemical Analysis and Characterization of Digestate. Dr. Daniel R. Talham is a Professor of Chemistry at the University of Florida. In 2013, he was awarded a University of Florida Research Foundation Professorship. Professor Talham received his Ph.D. at The Johns Hopkins University in 1985 under the direction of Professor Dwaine O. Cowan. After graduate school, he accepted a postdoctoral fellowship at Oxford University to study superconductivity and magnetism in the laboratory of Prof. Peter Day. His postdoctoral studies in Europe also included six months at the Université Paris-Sud, Laboratoire de Physiques des Solides. In 1987, Dr. Talham moved to a postdoctoral position at the Massachusetts Institute of Technology to work with Professor Mark S. Wrighton, studying molecules and polymer modified microelectrodes. Professor Talham began his appointment at the University of Florida in 1989, and he was promoted to Full Professor in 2000. In 2002, he was named Gibson Professor, and in 2006 he was appointed Chair of the Department of Chemistry by the Dean of the College, a position he held for two terms until 2012. He has published 175 articles in peer-reviewed literature and has mentored 25 Ph.D. theses. Professor Talham's research interests continue in materials chemistry and materials surface chemistry. Current projects include the study of inorganic surfaces as biomaterials as well as inorganic networks for magnetism and light-switchable magnetism.

Education Outreach

Dr. Mengyu Li for Student Involvement and Outreach. Dr. Mengyu Li is an Instructional Assistant Professor in the Department of Industrial and Systems Engineering (ISE) at the University of Florida (UF). In addition to her academic responsibilities, she serves as the director for the Outreach Engineering Management (OEM) Program, where she plays a vital role in shaping the program's success. Prior to her current position, Dr. Li gained invaluable experience as a product developer at a manufacturing company, where she was able to apply ISE principles and knowledges in an industrial setting. This work resulted in her receiving numerous awards for her accomplishments. Dr. Li has expertise in systems engineering and sustainability with applications through engineering design education. Since 2019, Dr. Li has been the lead instructor for the ISE Senior Design Project. She has proven her ability to manage multiple projects efficiently and has extensive experience in team based.
engineering design courses.

Design, Build, and Construction (EPC)

Haskell. "Founded in 1965 and headquartered in Florida, Haskell is the leading Florida-based design- builder. The firm has grown to more than 2,200 employees, with nearly half living and working in Florida. Our commitment to value and quality has translated into an 80% repeat client base, 3,900 collaborative

Source: From Haskell

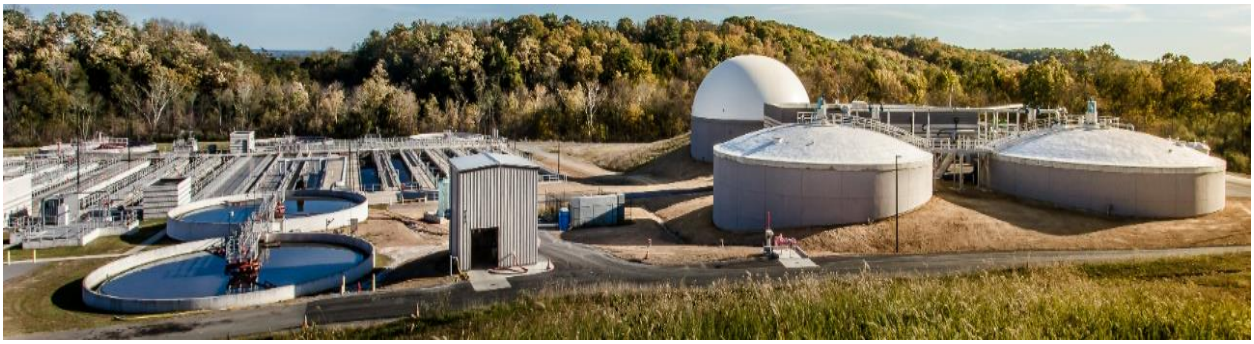
delivery projects with annual sales of over $2.5 billion. Evidenced by our perennial recognition in ENR as one of the nation's top design-builders and contractors, our proven track record speaks for itself.

Haskell's commitment to quality has resulted in repeat client engagements, profitability, and industry expertise. Our Quality Performance Rating (QPR) metric comprises three data points and gauges our adherence to project quality commitments, client experience, and leadership expectations. It empowers team members to measure quality, identify trends, drive training and education, and better assure certainty of outcome on their projects."[31]

Past Project: Opequon Water Reclamation Facility Green Energy Project Frederick-Winchester Service Authority (FWSA) | Winchester, Virginia

- Project Size: 54-mgd average flow
- Start and Completion Date: June 2016 | February 2017
- Contract Value: $45 million
- Equipment:
    - New Anerobic Digesters
    - New Dewatering System
    - CHP System
    - Co-Digestion, High Strength Waste Receiving
    - Biosolids Mixing Systems

Figure 22: Opequon Water Reclamation Facility in Winchester, VA



Source: From Haskell

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