Carbon Cycle, LLC

**Business Plan Version 1.0**

**11-01-2016**

# Carbon Cycle Executive Summary

Carbon Cycle, LLC is a triple bottom line company (People, Planet, and Profit) that will operate as a subsidiary of Enginuity, LLC. Formed as a renewable energy company, it completes the Enginuity vision of Food, Water, and Energy. Our mission is to create renewable energy and carbon based products while reducing landfill waste and recovering energy from industrial wastes. Our proprietary process converts wastes to liquid bio-fuels, bio-char, and carbon based materials for use in a multitude of industries and technologies.

The business model works by accepting tipping fees for organic feedstock, thermally converting them and producing liquid fuel and carbon solids. These by-products will then be sold to the supplier of the feed stock and other market segments. The process will include material handling, gasification, fractional distillation, material processing and packaging for commercial and retail sales.

The major benefits of this projects process and products include but are not limited to local economic stimulus, reduction of waste, reduction of pollution, increased agriculture output, improve animal welfare, and even human health.

The plan progresses through tollgates and moves from a demonstration phase to scale-up and expansion. The core technology is modular and expandable.

The project is formed as a separate entity to involve outside partners. Round A funding has been started with $xxx,xxx raised to date broken into two allocations, the second allocation guaranteed if certain milestones are achieved as planned.

# Market Analysis

There are four main markets the Carbon Cycle project supports: Waste-to-Energy (WtE), Biofuels, Biochar, and Carbon Materials.

Waste to Energy (WtE) is a large market space. The market is primarily supported by thermal-based incineration and biological processes. Incineration is the dominant technology representing 80-90% of the market, but also contributes to emissions/greenhouse-gases and is evolving. Biological waste-to-energy processes are based on anaerobic digestion, but can only work with specific feedstocks that mostly apply to agricultural operations. The alternative technologies that are witnessing increased demand are pyrolysis, gasification, and plasma arc gasification. These new technologies significantly improve efficiencies and reduce emissions. Carbon cycle is a next-generation waste-to-energy company that will enter a growing market with real need driven by market and regulatory forces.

The secondary market considered is the biofuels market. Biofuels is mainly comprised of bioethanol and biodiesel. Globally, 26 billion gallons of ethanol and 8 billion gallons of biodiesel were produced in 2015. United States is the world leader in production of both ethanol and biodiesel.

## Market Size

Waste to Energy Market:

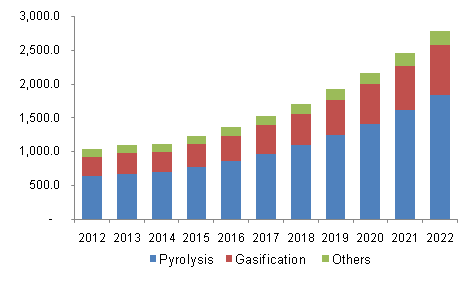
* Global WtE market valued at $24 Billion in 2012. ([source](http://www.grandviewresearch.com/industry-analysis/waste-to-energy-technology-industry))
* Global WtE market valued at ‘over $20 Billion’ in 2015 with greater than 6.5% CAGR through 2024. ([source](https://www.gminsights.com/industry-analysis/waste-to-energy-wte-market))
* United States WtE market expects 6% CAGR. ([source](https://www.gminsights.com/industry-analysis/waste-to-energy-wte-market))
* Global WtE market capital expenditures of $11.8 Billion in 2016. ([source](https://www.thestreet.com/story/13864885/1/waste-to-energy-wte-market-outlook-2016-2026.html))
* 84 WtE facilities in the United States generated $3.2 Billion revenue in 2011. ([source](http://acore.org/files/pdfs/ACORE_Outlook_for_RE_2014.pdf))
* Europe led and somewhat stalled with current crisis. Japan a big player. China, India, and US current growth areas. ([source](http://www.transparencymarketresearch.com/waste-to-energy-market.html))
* $3.9 Billion in global new investment in waste-to-energy for developed nations in 2015. ([source](http://www.ren21.net/wp-content/uploads/2016/10/REN21_GSR2016_KeyFindings_en_10.pdf))

Biofuels Market:

* Global biofuels market expected to grow at 5.9% CAGR 2016-2020. ([source](https://globenewswire.com/news-release/2016/09/22/873796/0/en/Global-Bio-fuels-Market-Growth-at-5-87-2016-2020-Key-Vendors-are-ADM-INEOS-Enterprises-Neste-Renewable-Energy-Group.html))
* Global biodiesel production increased 7.5% in 2010, to nearly 19 billion liters. United States biodiesel production fell, however, by nearly 40%. ([source](https://web.archive.org/web/20110905003859/http:/www.ren21.net/Portals/97/documents/GSR/GSR2011_Master18.pdf))
* $2.1 Billion in global new investment in biofuels for developed nations in 2015. ([source](http://www.ren21.net/wp-content/uploads/2016/10/REN21_GSR2016_KeyFindings_en_10.pdf))
* US biodiesel production rose 2% in 2015 to 1.3 billion gallons. ([source](http://www.ren21.net/wp-content/uploads/2016/10/REN21_GSR2016_FullReport_en_11.pdf))

Biochar Market:

* North American biochar production was around 550,000 tons in 2013. ([source](http://www.transparencymarketresearch.com/biochar-market.html))
* North American biochar production was around 656,000 tons in 2014. ([source](http://www.grandviewresearch.com/industry-analysis/biochar-market))
* Pyrolysis technology expected to grow at 11% CAGR through 2022. ([source](http://www.grandviewresearch.com/industry-analysis/biochar-market))
* Global biochar market estimated at $4.3 Million in 2015 with 17.1% CAGR through 2023. ([source](https://www.psmarketresearch.com/press-release/global-biochar-market))



**United States Pyrolysis Technology Market Revenue ($USD Million)**

## Market Drivers

The main market driver of the WtE market is regulatory compliance on waste disposal. Both WtE and Biofuels are driven by current and future regulatory requirements on greenhouse gas (GHG) emissions. Energy security and increased renewable energy demand drive investment in both WtE and biofuels. The current market for oil is seeing depressed prices, but long-term projections still highlight the need for additional sources of oil for energy and transportation. Additional drivers of the WtE and biofuel markets, especially overseas, are tax incentives that include high landfill taxes, renewable portfolio standards, carbon taxes, and direct subsidies to renewable energy projects.

**US Federal and State Regulatory Drivers:** The Renewable Fuels Standard (RFS2) requires that 36 billion gallons of biofuels are used by transportation by 2022. With less than 2 billion gallons being produced in the US now, there is a strong need to increase biodiesel production. In addition, Renewable Portfolio Standards in each state are requiring the growth of renewable energy production. Energy security continues to be a large driver for biodiesel and renewable energy production as well.

**The Waste Hierarchy:** In 2008, the European Parliament finalized [Directive 2008/98/EC](http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:ev0010&from=EN&isLegissum=true) that established the waste hierarchy as the best environmental solution and a regulatory requirement. It confirmed the principle of the ‘polluter pays’ and introduced the concept of ‘extended producer responsibilies,’ which include landfill and emissions taxes. Because of the improved regulatory environment in Europe and elsewhere overseas, U.S. companies are focusing less on the domestic market. The United States Environmental Protection Agency has the same hierarchy, but currently not a regulation. In the in the U.S., local regulatory bodies are responsible for waste management with the Federal Government having a small role in legislation development to date.

The waste hierarchy is based on the traditional reduce, reuse, and recycle, but includes recovery of energy, and disposal. The Carbon Cycle Process recycles the carbon present in biomass for use in industry or agriculture, while recovering energy in the form of bio-diesel and electricity. It is important to note that the current market technology for energy recovery is incineration, which is a technology fraught with environmental and political issues because it pollutes as well. The Carbon Cycle Process improves the Energy Recovery need with no negative air effluents.



**Waste Hierarchy and Carbon Cycle Relation**

While the current oil market is depressed, which affects both WtE and biofuels markets, there is a high degree of potential investors and governments see in producing energy and biodiesels from wastes. The costs of facilities for waste to energy or biodiesel production are high, but the costs of exploring, extracting, refining, and transporting from distant locations of traditional oil is increasingly expensive. Finding value and energy in the massive amounts of waste produced by developed nations is promising. This promise keeps investment and government incentives progressing.

**The Biochar Market** is an emerging market that is expected to grow big because of the environmental benefits and the enhanced productivity. Universities and various research institutes continue to study biochar and they show the likelihood for explosive growth because of the benefits. Biochar certification and standards are gaining momentum. Biochar products product healthier soil, maintain its pH, increase water holding capacity, improve seed germination, and improve soil resistance to fungus/insects. Biochar fits in the soil amendment market while also promoting carbon sequestration and soil/water quality improvements. All of these factors indicate the market is about to take-off. Research and policy papers make the case that carbon should be locked up in the soil, using biochar, instead of in plants and trees that eventually decompose ([source](http://www.nature.com/nature/journal/v447/n7141/full/447143a.html)).

# Company Description

# Organization and Management

## Management and Qualifications

President and COO

## Operations

## Design and Engineering

## Project Management

# Marketing and Sales Strategy

# Product Line and Services

## Technical Overview

The Carbon Cycle project is a process that takes waste feedstocks and converts them to bio-fuels, bio-char, and usable carbon raw materials. The proprietary process is based on pyrolysis, gasification, and similar technologies. According to the Energy Recovery Council, “Waste-to-Energy is a proven technology used globally to generate clean, renewable energy from the sustainable management of municipal solid waste (MSW).”

## **Feedstock**

The source of waste utilized for the project is industrial in nature. Industrial waste is normally separated from other materials and is therefore easy to use for recovery. Typical loads from industrial operations are homogenous and can be easily recovered for energy and carbon. Industrial waste includes cardboard, paper, food, metal, wood, plastics, textiles, and rubber. Nearly 11% of all Missouri waste is industrial. Here are two pictures that illustrate waste sources going to landfill that could be diverted to the Carbon Cycle facility, the first wood pallets and the second ‘chicken parts.’



## Project Plan

Overall

Milestones

Agreements and Permits

Schedule

Equipment Procurement and Installation

Resource Assessment

# Funding Request

## Funding Sources



## Investor Valuation



## Alpha Phase Funding:

The funding of this project is broken down by major milestones shown in timeline table below. The purpose of the Alpha phase is to learn and analyze the material feedstock composition and to prove out the technology for increased confidence for investors. In addition, this phase will allow for preliminary contracts for Grisham Farms, Bio-diverse energies, and value added fund raising from grant applications that are available for our project.

The tests that will be performed on the fuel, will give us insight on the process required to get it to an off-road diesel spec and allow us to go to potential customers with third party data to sell the fuel. The carbon char will also be tested to give us a more defined baseline of chemical composition, which will be used to present to different market segment customers.

Due to the high risk and direct lack of revenue from the first stage of Alpha funding. A 2X multiplier of the cash vested will be used for the cash equity for fund raising in stage Beta. For example; if an individual puts in $5000 now, this will equate to $10,000 at the time of Beta phase funding. Investing at this stage also ensures preferential equity valuation on the future phases. Carbon cycle understands the skin in the game.

## Alpha Phase Deliverables

* 1. Analysis of Grisham Farm feedstock. Samples will be collected for 2 weeks at random times to get a full profile of the feedstock. We will work closely to Grisham’s staff to research any feedstock anomalies that they might have
  2. Provide test analysis and report for additional feedstocks like tires, wood, and paper.
  3. Determine available fuel quantity, quality and specific composition for different potential end products
  4. Determine available Char output quantity, quality and specific composition for potential end products.
  5. Addressable market estimates – provide internet and quote research for target customers and 3rd party pricing estimates
  6. Final report will include test results and a series of product specifications to prepare for sales sheet brochures.
  7. Create preliminary contract with Bio-Diverse Energy (Dave Seidel)
  8. Create preliminary contract(s) for Grisham Farms for feedstock supply and sales of our own end products.

# Financials

There is more work that needs to happen here. First look at the overall business case is as follows (not a best case, certainly, but a start to begin to rough out the tough spots) I am working on this more:



## Financial Focus

1. Note, this is not a best case and I am using 200% overhead on indirect labor (25% on direct). This could be way overdone, but even so, the numbers are not good at this price of biochar until you get to the 2 ton machine.
2. Need to understand capacity of machine vs. cost. Business case looks best with 2ton machines. Anything smaller doesn’t pay off unless the indirect costs are significantly reduced, which means Enginuity has to shoulder it.
3. Price of biochar. The business plan rests on this (as you know). I have found figures supporting $200-250 per ton on the market. Most economic analysis of biochar was using these figures, but I am searching for more. Still, this is not the specialized stuff in small bags like this company ([Biochar Supreme](http://www.biocharsupreme.com/collections/frontpage/products/bob-s-ag-hort)), but I just want to figure a realistic cost/balance out.
4. Labor required on the machines. Is 1 handler and 1 tech enough?
5. Labor overhead rates. I took out employment taxes and am rolling it into the overhead rate, but there will be two rates you need to consider – direct and indirect. Indirect overhead gets tricky depending on what you are going to offer in regards to benefits / retirement, but you cover the electricity and facilities in the budget more than adequately. I can remove it from the analysis too. I can create a better looking version of everything for investors too.
6. Key question: how do we deliver biochar and biodiesel to the market? You have sling bags, 50 gallon drums, and shipping included, but what about re-use of containers. Also, we should make the shipping cost be calculated based on weight/tonnage of what we ship. The key missing piece at this point is what is the physical market space, where does the product go, and how do we distribute it all. There are companies I have found that seem to take it and sell it. This is where the lower price point will come in certainly, but no logistics or sales immediately might make a good first step until we can build the team and sales penetration.
7. You have a line for waste disposal. How much ‘stuff’ is left after processing and how much needs to be disposed. I know moisture and volatiles are removed, but still, it seems like there is stuff to dispose of. Does this reduce the tipping fees on the backend when we have to pay for removal?
8. You include depreciation into the operating costs, but I don’t think you should for this case. It’s a fair tax measure, but is it real and hurting the bottom line at $25K per month?
9. Right now roughly 2.4% of loaded weight is converted to gallons of biodiesel. Does it scale this way or is there a limiting factor?
10. Need to review the indirect costs. Some seem high to me considering free heat/electricity possibly from the process.
11. I am still figuring it out, so forgive me. I think that the key is getting higher price points on biochar, like you said, but what does it take and how much of it can the market support? Also, marketing, sales, website development, and product engineering dollars will need to be spent, but I think you have some of those costs in there already. So this is what I think looking at the monthly breakdown, and when certain people are hired, and for what, makes more sense…keep costs low to start, show it sustainable, and then expand both volumes and price points as the overhead is added…and that is what I want to work on next, but we should catch up first!

# Competitive Analysis

## Competitive Edge – The Proprietary Process

The Carbon Cycle BioEnergy Process has key technical advantages. There are other companies, both large and small, engaged in the similar production of bio-fuels and plastics using renewable feedstocks from waste or biomass. There is large variation in the size and feedstocks of projects, but ventures do exist and are profitable using similar processes.



Global waste to energy market share is competitive with **Covanta**, **Tenologies**, **Wheelabrator**, **Hitachi Zosen**, and **Keppel Seghers** being considered major industry players. Other industry participants include **Xcel Energy**, Veolia Environment, **Mitsubishi Heavy Industries**, **Green Conversion Systems**, **Foster Wheeler**, **China Everbright International**, and **Plasco Energy**.

## Technology Advantage:

Biodiverse Energies, LLC has a unique process with benefits.

## Biochar Market Competitors

The biochar market is fragmented with **Biochar Supreme, LLC** being a major player. Timber companies such as Weyerhaeuser, Georgia-Pacific, and West Fraser supply wood residue and wood pellets to various biochar manufacturers. The industry is comprised of many individual and small companies including **Cool Planet Energy Systems Inc**., 3R ENVIRO TECH Group, **Pacific Pyrolysis**, and **Phoenix Energy** provide pyrolysis technology to produce the product and waste to energy solutions.

**Ambient Energy LLC:** Located in Washington, they provide comprehensive solutions for waste to energy gasification. [www.ambientnrg.com](http://www.ambientnrg.com/)

**Advanced Biorefinery Inc:** Located in Canada, they develop and commercialize affordable, transportable pyrolysis plants. [www.advbiorefineryinc.ca](http://www.advbiorefineryinc.ca/)

**Agritherm LTD:** Located in Canada, they develop, manufacture and market portable and stationary equipment for producing bio-oils and products from biomass, specifically ag residues, wastes and transition crops. [www.agri-therm.com](http://www.agri-therm.com/)

**Alterna Biocarbon:**Located in Prince George, British Columbia, Canada, they offer new biomass conversion technology called the "Enviro Carbonizer".[www.alternaenergy.ca](http://www.alternaenergy.ca/)

**Avello Bioenergy:**Located in Iowa, they are commercializing proprietary technology in biomass fast pyrolysis. [www.avellobioenergy.com](http://www.avellobioenergy.com/)

**Biochar Solutions:** Located in Carbondale, CO, they offer wholesale biochar as well as equipment such as the B-1000 Thermal Conversion System.[www.biocharsolutions.com](http://www.biocharsolutions.com/)

**Biochar Supreme:**Located in Everson, WA on the west coast just south of Canada.  They offer Black Owl biochar blends for specific applications by the bag, cubic foot, cubic yard or truckload.  [www.biocharsupreme.com](http://www.biocharsupreme.com)

**Biz Solutions LLC:** Located in both the US and Canada, they are a renewable/alternative energy project development company that specializes in the pyrolization of various fuel sources. [www.pyrogreen.com](http://pyrogreen.com/Home.html)

**Carbon Brokers International:** Located in Boulder, Colorado, they sell sustainable, renewable replacements to fossil fuel and offer coal substitutes, bio-crude oil, activated carbon and soil biochar. They currently have more than 200 tons of biochar available [www.carbonbrokersinternational.com](http://www.carbonbrokersinternational.com/)

**Carbon Char Group:** Located in Hillsborough, New Jersey. In addition to selling biochar they are starting to develop biomass pyrolysis systems. [www.carbonchar.com](http://www.carbonchar.com/)

**Carbon Resources:**Various locations throughout the US. They sell activated charcoal products. [www.carbonresources.com](http://www.carbonresources.com/company.html)

**Dynamotive Energy Systems Corp:** Located in Vancouver, Canada, they are an energy solutions provider with offices in the US, UK and Argentina. [www.dynamotive.com](http://www.dynamotive.com/)

**Ecovolve (re:char)**: Located in New York, New York, they are an innovative developer of carbon negative technology. They offer patent-pending biomass pyrolysis technology and were featured on Good Morning America. [www.ecovolve.com](http://www.ecovolve.com/)

**Eprida**: Located in Georgia, they offer sustainable energy technology. [www.eprida.com](http://www.eprida.com/)

**GEK Gasifier**: They offer the gasifier experimenters kit for anyone from the do-it-yourselfer to experts. The kits produce clean gas and biochar products.[www.gekgasifier.com](http://www.gekgasifier.com/)

**Genesis Industries**: Located in California, they are currently working internally and with several international partners to develop the Genesis brand of pyrolysis.[www.egenindustries.com](http://www.egenindustries.com/)

**HM3 Energy**: Located in Oregon, they provide torrefied biomass pellets that can replace coal without system modifications. [www.hm3e.com](http://www.hm3e.com/)

**Landscape Ecology**: Located in Hawaii, they offer biochar production and sales in Hawaii. In addition to biochar they offer landscape design often utilizing biochar.

**New England Biochar**: Located in Massachusset, they provide biochar compost, biochar and portable and modular retort systems. [www.newenglandbiochar.org](http://newenglandbiochar.org/Home.html)

**R & A Energy Solutions Inc:**Located in Ridgeville, OH, they provide integrated, modular pyrolysis and combined heat and power generation equipment for the dairy, cattle feedlot, recycling, waste hauling, municipal utility and auto shredding industries. [www.randaenergysolutions.com](http://www.randaenergysolutions.com/)

**Renewable Oil International LLC**: Located in Alabama, they are developing advanced Fast Pyrolysis Biorefinery Technology to cost effectively fractionate wood and other types of biomass into high value products. [www.renewableoil.com](http://www.renewableoil.com/)

**Syngest Inc**: Located in Iowa, they manufacture bio-ammonia from biomass that can be used as both bio-fuel and fertilizer. [www.syngest.com](http://www.syngest.com/)

# Enginuity Executive Summary (old)

Enginuity is built for dynamic growth and revenue around paradigm changing innovations in products and services centered on its core divisions of water, food, energy, and sustainable products and services.

RainReserve™ is an established, quality-branded, and complete product line that serves various market segments in the rainwater harvesting market. The Build-A-Barrel™ water storage system was launched in 2013 and expanded the product line to water storage and modular tanks. This helped RainReserve™ move into the water storage and installation services market segment, which is the largest. RainReserve™ is now a complete product line generating a consistent revenue stream.

Current revenues streams include bio-medical (heels and pads), marine-electric, incubation services (EMERGE), and food-machine (Injerra) projects. Additional new revenue streams include food production, food distribution, energy systems (gassification (SRADCO), and other business partnerships, incubator relationships, rentals, and non-profit cooperatives.

Enginuity’s new headquarters, in Mansfield, MO, is situated to offer many regional benefits including lower labor costs, shared overhead, and access to a wide range of talent including Springfield, MO, in the heart of the country. Our goal is to incubate and build innovative products that create sustainable businesses in the region.

## Company Description

Enginuity is an LLC, specializing in design, manufacturing, assembly, tooling, and marketing. Now established with 50k sq-ft facility in Mansfield, MO, Enginuity has built a business around manufacturing, assembly, marketing, and retail sales with a complete ‘turn-key’ operation delivering products in the consumer retail, medical, aerospace and marine industries. With 50,000sq-ft of manufacturing, incubation, rental, warehouse, and food production space available for development, Enginuity continues to expand revenues and innovation.

## Objectives

* Grow RainReserve™ into the market category leader with $2MM in annual sales revenue by the end of 2016.
* Start production of the Injera Bread machine which could bring in $500k to $1MM yearly and continually over the next 5-10 years.
* Evolve Enginuity business systems, with 2014 priorities on sales and finance, and a 2015 priority on scalability.
* Continue to revitalize the Ozark Innovation Center headquarters and develop rental-incubation revenues to achieve rent free Enginuity
* Convert intellectual capital and concepts into revenues.

## Mission Statement

Enginuity will comprise of, support and incubate businesses developing innovative products around the areas of water, food, and energy. Enginuity’s aim is to create a sustainable business model that fosters creativity between like-minded innovators focused on building ‘triple-bottom-line’ (profit, people, and planet) businesses for evolving markets and global challenges.

## Capabilities

In-House Capabilities:

* Injection Molding
* Machine Design
* Assembly and Packaging
* Machining, Stamping, and Welding
* Design and Prototyping
* Tooling-Mold, Die, and Fixturing
* Software and Website Development
* Digital and Analog Electronic Design
* Warehousing, Distribution, Order Processing, Controls

Ozark Innovation Center Details:

* 15k sq-ft business incubation rental space
  + Office
  + Manufacturing
  + Classroom
* 5k sq-ft kitchen space
  + Refrigeration and Freezer
  + Kitchen Incubation
* 0.5 MW Back-up Generator, future renewable energy revenue stream
* Retail space, garden space, and community center space
* Main highway access with central shipping zone

## Management: