

Biosystems Engineering Five Years of Impact 2018-2022 Report



Biosystems Engineering PLLC...

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LAND ACKNOWLEDGEMENT

Biosystems Engineering, PLLC (BE) would like to acknowledge that our brick and mortar foundation began on the land of the Eno, Tutelo, Saponi, Occaneechi, and Shakori Native people. Land that was traditionally part of the territory of the Saponi people, in the Piedmont of what is now the state of North Carolina and in the town now called Carrboro. This area is not far from the "Great Trading Path", used by both the native people of this area and non-native peoples during the early years of contact. The Saponi people, whose descendants include the Occaneechi Band of the Saponi Nation Indian Tribe still thrive and live in this region, officially recognized by the state government of North Carolina. We pay respect to their elders past and present. The Occaneechi People (The Ye'sah), ask that you will keep these thoughts in mind while on their ancestral lands and treat it with the respect, love, and care that their Ancestors did, and as the Occaneechi Saponi people do so today.

We respectfully acknowledge and credit the <u>OBSN Tribal Council</u> for this land acknowledgment and remind us all that we are all, always, on Native Land.

To learn more and discover the ancestral land where you are walking upon please explore here.

BE also wishes to respectfully acknowledge and honor the many African-American people who contributed to building Carrboro's community. These people were freedmen (and women) and slaves, craftsmen, farmers, cooks, nursemaids, mothers and fathers. Some were here by choice and some were here because of slavery. Those who were enslaved contributed much to this community(...).

The descendants of these...[enslaved people]...have prospered in this land. After slavery they assumed the name of Weaver and went on to make this community their own. They became and are community leaders, school teachers, college professors, public administrators, and good citizens.

Source: African American Cemetery Marker, Carrboro NC

FOUNDER'S STATEMENT

Our family founded Biosystems Engineering, PLLC (BE) in 2018 as our best yet approach to being the change we want to see in the world. We wanted to provide for ourselves by providing for others. We envisioned doing this through high quality professional services, an internal culture of generosity and giving back to the communities that make our work possible.

Throughout the first five years BE's offerings have taken many forms. We began doing what we knew best at the time: industrial engineering and project management. We commissioned a 10 million gallon per year biodiesel plant, reviewed construction plans for hemp processing facilities and helped retune ethanol plants from fuel grade ethanol to hand sanitizer. After Covid hit and onsite travel became more difficult, we pivoted to auditing and audit preparation for the International Sustainability and Carbon Certification (ISCC) and the California Low Carbon Fuel Standard (LCFS). We provided these services to over 50 clients across North America and Internationally. This work became the basis for our Traceability business line. Our success in Traceability afforded us the opportunity to grow a business line providing life cycle assessments (LCA's) and greenhouse gas (GHG) accounting with a focus on biochar-based carbon removal which has become our Carbon Accreditation business line. Today BE offers services in Engineering, Traceability and Carbon Accreditation.

In addition to providing for clients, we have endeavored to dig deep into understanding the causes and mechanisms of economic disparities in the US. We have studied systemic racism, able-ism, privilege, equity and fairness. This led to the development of one of our three core values: Mutual Equity, which is woven into company culture. It calls the members of BE to bring sensitivity and an attitude of curiosity to matters of inclusion. We also openly discuss the historical perspectives which have led up to and continue to influence the distribution of wealth and opportunity in US society including historically unpaid or underpaid labor, land access, land rights and broken agreements. We view these as noteworthy parts of the foundation of the economy in which we do business today, and we feel called to participate in creating a safer, saner, fairer playing field. As a company we commit a portion of our annual gross revenue to Mutual Equity Initiatives, digging into this work, building relationships across economic, racial, and cultural lines and paying down some of the debts that have been passed forward over generations.

Climate change has been a concern, interest, and core opportunity for BE from the beginning. In engineering, we focus on renewables and bioprocessing. In Traceability, we work with companies who wish to handle certified sustainable materials within the principles of the ISCC framework. In Carbon Accreditation, we have gone after the most accessible, technologically ready and cutting-edge appropriate carbon mitigation and soil building technology we can find: biochar. We also account for our own carbon emissions and purchase avoidance offsets from reputable providers in quantities far greater than the amount of carbon that we expend. As we move forward, we will strive to purchase carbon removal offsets designed to remove for at least 100 years an equal or greater amount of carbon from the atmosphere than we emit. We are also looking into installing solar or other methods of renewable electricity to directly counterbalance the electricity and/or other emission sources from our work.

To formalize our value commitments in services, our community and the environment, we have pursued and achieved B Corporation certification[®]. The framework utilized in the B Impact Assessment, created by B Lab Global provides us with a structure to help guide us on our journey toward meeting the UN's Sustainable Development Goals. In order to maintain our B Corp status we are required to recertify every three years, this external third party audit further helps us to operate BE in an accountable and transparent manner, helping us to continue to stay on purpose. As a Certified B Corp[™], we are a few among many working toward a better world for ourselves and others. We do good work, have fun and strive to maximize our creation of the world we want ourselves and the next generation to live in.

Let's Be On Purpose Together!

Lick Shuruken

J. Link Shumaker, PE Biosystems Engineering, PLLC Founder, Managing Member

WHO WE ARE

Biosystems Engineering, PLLC (BE) is a family owned and operated professional process consultancy in Carrboro, North Carolina which was founded by the Shumaker family in March of 2018. We were inspired to create this business in support of the regenerative, circular bio-economy. BE is committed to being a forerunner in changing the way business is done. We believe it is a necessary and conscious practice to deliberately acknowledge and share privilege and make every possible effort to level the playing field. In line with this awareness, BE commits 5% of gross revenue to Mutual Equity Initiatives, both internally, for Team education and training and especially externally where we wish to elevate individuals and organizations (for profit and non-profit) that are focused on racial, environmental and social justice work.

Our Core Values: Stellar Client Care : Generous Self Care : Mutual Equity

BE's Purpose is to meet the engineering needs of the regenerative bio-circular economies, provide for the wellbeing of ourselves and our families, and co-create a safer, more equitable society. We as an organization are committed to pursuing our purpose in a way that amplifies our individual purposes in life. We align our decision making to our purpose through our Core Values. When we act in balanced alignment with our Core Values it ensures that we are on Purpose. When we are on Purpose, we amplify the individual Purposes of the Team, the Clientele, and the Stakeholders. We All Win.



LET'S BE ON PURPOSE TOGETHER!

WHAT WE DO

Three Business Lines

At BE our services are highly customized to meet the unique goals of each sector. We work closely with manufacturing facility owners, operations teams, technology providers and investors.

Carbon Accreditation with a focus on Biochar Carbon Dioxide Removal (CDR)

Services include Initial Scoping and Assessment Calculations to determine the CDR Credit potential of your project, CDR Credit Ecosystems Navigation, European Biochar Certification (EBC) and Puro.earth Methodology Support as well as Accreditation Audit Support. Additionally, we offer Life Cycle Assessments (LCA) and Greenhouse Gas (GHG) Calculations on a case by case basis per ISO 14040/44, 14064-1,-2,-3 and 14067.



"Link and his team at Biosystems Engineering are my go-to for any questions on life cycle assessments and the carbon markets. I find them to be extremely knowledgeable, approachable with deep integrity and they are genuinely nice to work with."



Kathleen Draper Board Chair at International Biochar Initiative (IBI), US Director - Ithaka Institute for Carbon Intelligence, U.S.

Engineering & Project Management

We provide Process Engineering and Project Management Services for the biomass, biofuels and bioenergy sectors with a focus on small to medium scale industrial facilities. We have deep expertise in biodiesel processing as well as several years of hands-on process experience in biomass pelleting (on the 2,000 ton per day scale) and advanced pyrolysis chemistry (on the 1 ton per day scale).



"Link and Biosystems Engineering, PLLC helped our team develop a \$15 million CAPEX industrial renovation project from Nov. 2019 to Nov. 2020. Link actively worked among our internal team & external engineering firms, vendors and contractors on our behalf. He actively contributed to the initial assessment of an industrial asset, many discussions with subject matter experts & equipment providers, development of a holistic process plan, solicitation of detailed engineering and equipment guotes, and establishment of a budget and Gantt chart based timeline. This project involved using well-established technology in an innovative and unprecedented way. We look forward to working with (BE) again when the time is right."



lakeview 🌲

Eamonn Byrnes COO & Founder, Lakeview Energy, LLC

Traceability

We provide supply chain traceability consulting with a focus on the International Sustainability and Carbon Certification (ISCC) and California Low Carbon Fuel Standard (LCFS) systems. Our ISCC standard offering includes Scoping, Training, Complete Documentation, Internal Audits and External Audit Support.



CALIFORNIA AIR RESOURCES BOARD

Low Carbon Fuel Standard

"Link & his team helped us in preparing for the International Sustainability & Carbon Certification (ISCC plus). Their knowledge and approach were a great asset to our project and as a result we were able to obtain the ISCC. We look forward to continuing our collaboration with him in the future. "



Pablo Marchant, Project Mgr. & Scrum Master, M Holland Company

CARBON TRACKING & OFFSETTING

Since the company's inception, BE has purchased carbon offsets for company travel. Beginning with the founder in 2019 carbon offsets were also purchased for each team member for the months worked at a rate of the average of the emissions of a U.S. citizen. Below are our GHG calculations for the first 4 years of the company's existence.

4 Year GHG Account	2018	2019	2020	2021	2022	48 Month
	Mar-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Feb	Total
Scope 1 (Direct)	53.30	91.53	87.96	92.98	39.93	365.70
Scope 2 (Indirect)	70.11	84.69	74.57	187.35	47.83	464.55
Scope 3 (Other Indirect)	2,582.21	4,667.13	2,180.73	932.21	-	10,362.28
Total emissions (kg CO2e)	2,705.63	4,843.36	2,343.25	1,212.54	87.76	11,192.53
Total emissions (mt CO2e)	2.71	4.84	2.34	1.21	0.09	11.19
Carbon Offsets	-	26.85	16.33	95.00	16.70	154.88
Carbon Removal Credits	-	-	-	7.43	-	7.43

Emissions sources considered: Home Office electricity and Natural Gas for Core Team, Business Travel (Car and Airplane)

Scope 1 = Natural gas for home offices and on-road travel in personal vehicles

Scope 2 = Home Office Electricity

Scope 3 = Air travel, rental car/Lyft/taxi travel

GHG emissions by source (averaged from March 2018 – February 2022)

The following table details GHG emissions by source, including by building for natural gas and electricity, and by type of haul (short or medium) for air travel. The results of the GHG inventory indicate that the two biggest contributors are leased vehicles (62.87% of total) and air travel (29.71% of total).

Source	GHG Emissions (kg CO2e)	% Total
Natural gas	91.42	3.27
Building A	89.43	3.20
Building B	2.00	0.07
Electricity	116.14	4.15
Building A	84.40	3.02
Building B	0.31	0.01
Building C	31.43	1.12
Leased vehicles	1,759.15	62.87
Air travel	831.42	29.71
Short haul	24.66	0.88
Medium haul	806.76	28.83
Total	2,798.13	100.00

Carbon credits vs. GHG emissions inventories (mt CO2e)

145.61 - BE's Carbon Credit Inventory

11.19 - BE's GHG Emissions Inventory

3.27% 4.15% Air Travel Natural Gas Electricity Leased Vehicles 62.87%

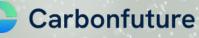
GHG Emissions by Source

Offset Projects Being Supported:

Honduras Water Project Native Energy (purchased between Oct. 8th, 2019 and Dec. 7th, 2019) - 26.85 mt CO2e Personal Carbon Offset Package Terrapass (purchased December 2nd, 2020) – 16 mt CO2e

Pacific Biochar 2020 Biochar Carbon Dioxide Remove Certified by the European Biochar Certificate and provided by Carbonfuture (purchased July 27, 2021) – 7.43 mt CO2e removed

REDD in the Yaeda Valley Native Energy (purchased November 19th, 2021) – 95 mt CO2e removed









MUTUAL EQUITY INITIATIVES

U.N. Sustainable Development Goals (SDGs) in Action at BE

Our impact focus area is the healing and regeneration of the Planet and its People with a focus on removing barriers to opportunity for historically marginalized and/or over-traumatized groups. We impact this area by seeking out direct relationships and consciously sharing our wealth and privilege.

In line with this purpose, beginning in 2020, BE decided to formally commit 5% of gross revenue to Mutual Equity Initiatives, which has grown to include both internal education and training for Team members, and especially external initiatives where we wish to elevate individuals and organizations (for profit and non-profit) that are focused on racial, environmental and social justice work.

We will be further showcasing our commitment to mutual equity by sharing our supplier tracking data illustrating our focus on suppliers who are from the local community and diverse and marginalized populations.

Mutual Equity Initiative Spending by Year

Mutual Equity Initiative Spending and Total Revenue							
	2020	2021	2022				
Total Mutual Equity Spending	g \$11,066.25	\$15,750.00	\$15,913.49				
	Ger 3 GOOD HEALTH AND WELL-BEING	6 CLEAN WATER AND SANITATION					
10 REDUICED INEQUALITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	16 PEACE. JUSTICE AND STRONG INSTITUTIONS					





Biosystems Engineering







This project supports



Location: Pittsboro, NC

Project: Women led, Social/Environmental/ Community Non-Profit whose soul work is curating cultural events, community gatherings, curious discussions, educational workshops, and group ceremonies. They help facilitate connection of all beings to flow within the natural, cyclical rhythms of the universe.



https://abundancenc.org





This project supports



Location: Durham, NC

Project: Neurodiverse, LGBTQ+, Disabled led non profit whose mission is to enable and empower the Autistic and Neurodivergent community through the principles of Disability Justice; to shift the narrative of disability through relationships, education, and advocacy; and to support self-determination and access to employment, transportation, housing, mental health services, and food security.

https://www.asacdurham.com





This project supports



Location: Headquartered in Los Angeles, with its Navajo Water Project team working from locations in Thoreau, New Mexico, Navajo Mountain, Utah, and Dilkon, Arizona and serving households on the Navajo Nation throughout Arizona, New Mexico and Utah.

Project: Indigenous led and registered as an official enterprise on the Navajo Nation, the Navajo Water Project is a community-managed utility alternative that brings hot and cold running water to homes without access to water or sewer lines.

https://navajowaterproject.org



2020 - 22 Mutual Equity Partner



This project supports



Location: Paducah, KY

Project: Environmental Non-Profit whose mission is to provide an innovative sustainable and community-based solution for addressing the issue of mismanaged plastic waste around the world. ESES helps developing communities take control of their waste plastic challenge with Trash to Tank technology.



https://eses-plastic.org



2020, 2022 Mutual Equity Partner



This project supports



Location: Orange County, NC



Project: Woman owned non-profit that connects community members through multi-generational and inclusive relationships that build enrichment opportunities for youth and adults alike & envisions a vibrant and interconnected community that equitably enriches all of its members socially, emotionally, intellectually, and economically.

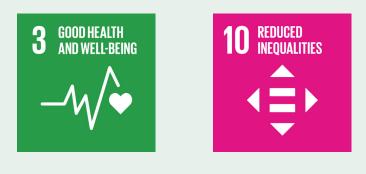
https://growyourworld.org



Handèwa Farms



This project supports



SUSTAINABLE CITIES

ND COMMUNITIES

Location: Rougemont, NC

Project: Indigenous women-led farming collective desiring to improve the quality of life for others. As an Afro-Indigenous led farming effort, the collective is comprised of members genuinely dedicated to farming, as well as providing access to fresh, quality food to insecure households and communities.

https://handewafarms.com



2021- 2022 Mutual Equity Partner

I AM SOTERIA



This project supports



Location: Orange County, NC

Project: Woman-owned business that has been using Artivism of all forms to bring communities together; using art to combat hate, bias and injustice of all kinds.

https://iamsoteria.com



2020 - 2021 Mutual Equity Partner



This project supports



Location: Graham, NC

Project: BIPOC Woman-owned business that provides racial equity consulting with a focus on the food system, strategies for supporting the growth of farmers of color, organizational and leadership development, research, evaluation, feasibility studies, facilitation, and a range of services to individuals and organizations seeking to deepen and apply a racial equity analysis to their work and missions.

https://seedsofchangeconsulting.org



[imala's Curryblossom Café

This project supports





Location: Chapel Hill, NC

Project: BIPOC Woman-owned business; "A long-standing activist for progressive causes, including environmental justice, grassroots media, farm-and restaurantworker rights, Vimala believes that delicious, wholesome food is a human right. She operates on the principle, "Vimala cooks, everybody eats," and thus no one is ever turned away from her restaurant." (Jennifer Curtis Firsthand News).

https://curryblossom.com

DIVERSITY/EQUITY/INCLUSION/JUSTICE TRAINING

At BE we are committed to a perpetual learning cycle especially in regard to raising conscious awareness for all Core Team Members in the concept of sharing privilege and understanding systems, dynamics of inequities and injustices and how to actively recognize and dismantle them.

To that end we are engaged in ongoing consultation, training, education and exploration of team culture, policies, and best practices in order to maintain a safe and inclusive space for all team members, clients, and all stakeholders.

All Core BE Team members are required to complete at minimum an Unconscious Bias Awareness online training. Additionally, through our Mutual Equity Commitment BE will offer opportunities, and team members may request to participate in relevant DEI and social and environmental justice training to remain engaged in this important growth and reimagining process.

Here are some trainings the BE Team has participated in for personal and professional development from 2018 - 2022:

Groundwater & Phase 1 training on structural racism Training delivered by the Racial Equity Institute, Greensboro, NC **Racial Equity Education: The role of being a white accomplice** Training delivered by Seeds of Change Consulting, Burlington, NC **Christianity DeConstructs Racism** Training delivered by Keith Daniel and Tom Droege, Resilient Ventures, Durham, NC **Diversity and Inclusion in the Workplace - Unconscious Bias Awareness** Online self-study training offered by Compliance Training Group White Caucus Meetings – Meetings that explore the impact of living in a white dominant society, how to heal and work together to bring about change. Sponsored by Organizing Against Racism (OAR), Durham, NC Inclusivity: Embodying Beloved Community Training delivered by Dr. Deborah Johnson, Inner Light Ministries / Agape University **Unmasking Privilege** Training delivered by Dr. Deborah Johnson, Inner Light Ministries / Agape University Implicit bias in childcare workers Training delivered by the state of New Mexico Master's Degree in Human Relations: Inclusive Leadership To be completed in Fall 2023 at the University of Oklahoma

DONATION OF TIME & TALENT BY BE 2018-2022

VOLUNTEER

- 1. Presented to NC Energy Policy Council at the request of the NC Department of Environmental Quality (NC DEQ) on May 3rd, 2018 published on Linkedin and the DEQ website (BioEnergy 101 Slides)
- 2. Presented at the BioCycle REFOR18 Renewable Energy from Organics Recycling 19th Annual Conference in Raleigh NC, October 17th, 2018 (Integrating BioRefineries)
- 3. Presentation to Undergrad Engineering Class at University of Kentucky -<u>Paducah: Biomass and the International Sustainability and Carbon Certification 2021</u>
- 4. Presented to the public in March 2022; C-Sink Summary
- 5. Presented to USDA ARS Southern Plains Research Center Earth Day Observance: Investing in the Earth presentation - April 22nd, 2022
- 6. Presented at the North American Biochar and Bioenergy Conference: LCA's for Biochar Workshop with open source slides: Life Cycle Assessments (LCAs) for Biochar Facilities and Carbon Markets - on August 8-9, 2022

PRO-BONO WORK

Northeast Biodiesel: (27+ hrs) ongoing weekly meetings of Process Engineering Advisement



BE DIVERSE SUPPLIER SOURCING POLICY

Whenever possible we seek to engage and give preference to suppliers who share our mission and values and especially those who identify in the following ways: Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Veteran Business Enterprises (VBE), small/micro businesses, non-profit organizations, governmental entities and all other purpose driven or underrepresented and historically marginalized business enterprises, as well local and community based organizations.

When it comes to hiring professionals (i.e. service providers, subcontractors etc.), we at BE strive to support other small business who's beneficial owners fall into these categories, local entrepreneurs, Minority Business Enterprise (MBE) including BIPOC, LGBTQ+, neurodiverse, and disabled business enterprises, Women Business Enterprises (WBE) Local/Community based and Veteran Business Enterprises (VBE).

Having a diverse supplier policy helps to align with our Purpose and Core Values recognizing that justice work and fairness in the US is simply a cost of doing business with integrity.

Proud to work with Women-Owned Certified B Corps





Supplier Data

2020					
80% Suppliers by Category	Total	Local*	Woman Owned	BIPOC Owned	LGBTQIA+ Owned
Total Dollars	\$48,207.68	\$36,545.06	\$44,593.26	\$14,210.30	\$250.00
Percentage		75.8075%	92.5024%	29.4773%	0.5186%

2021					
80% Suppliers by Category	Total	Local*	Woman Owned	BIPOC Owned	LGBTQIA+ Owned
Total Dollars	\$123,431.32	\$76,468.85	\$48,030.42	\$51,905.87	\$3,750.00
Percentage		61.95%	38.91%	42.05%	3.04%

2022							
80% Suppliers by Category	Total	Local*	Women Owned	BIPOC Owned	LGBTQIA+ Owned	Disabled Owned	B Corp
Total Dollars	\$165,832.26	\$34,428.74	\$117,986.28	\$107,312.38	\$10,500.00	\$3,000.00	\$3,686.50
Percentage		20.76%	71.15%	64.71%	6.33%	1.81%	2.22%



"We are honored to be partnering with Biosystems Engineering, PLLC (BE). BE strives to break corporate norms by truly caring about and prioritizing the positive impact it can have on its team members, clients, and the planet. BE has been an integral part of Sacred Blue's development and growth. We will forever be grateful for the support that we have received from BE's founder and team members in helping Sacred Blue emerge in the sustainability consulting field. We can't say thank you enough!"



With gratitude,

Chandni Joshi Jangid Chemical Engineering, BS, PhD Certified Sustainability Excellence Associate (SEA) Co-owner, Sacred Blue LLC

Core Team Members





Link Shumaker, MSc PE Founder, Managing member Carrboro, NC



Noreen Auterio Scoggins, M.A. Community Manager Boston, MA



Cait Collins Administrative Assistant & Internal Systems Support Alamogordo, NM

Biochar Carbon Accreditation Partners



Steve Boles, MSc, EP Ontario, Canada



Gundmundur Johannesson, MSc, PhD Ontario, Canada

ISCC Tracebility Partners



Chandi Joshi Jangid, PhD, SEA Co-owner Sacred Blue Jodhpur, India

SACRED BLUI



Ankit Jangid, MS Co-owner Sacred Blue Jodhpur, India

Sacred Blue LLC co-owners and Sustainability Experts, Chandi Joshi Jangid and Ankit Jangid, began their relationship with BE as interns, advancing to core team members berfore taking the initiative to create their own company. We are delighted to have been a part of their journeyand are grateful to continue what we feel is a mutually beneficial and rewarding relationship with Sacred Blue LLC

OUR INSPIRATION

"If you have come here to help me, you are wasting your time. But if you have come because your liberation is bound up with mine, then let us work together."

Aboriginal activists group Queensland, 1970s

B CORP DECLARATION OF INTERDEPENDENCE

We envision a global economy that uses business as a force for good. This economy is comprised of a new type of corporation – the **B** Corporation – which is purpose-driven and creates benefit for all stakeholders, not just shareholders. As Certified B Corporations and leaders of this emerging economy, we believe:

- That we must be the change we seek in the world.
- That all business ought to be conducted as if people and place mattered.
- That, through their products, practices, and profits, businesses should aspire to do no harm and benefit all.

To do so requires that we act with the understanding that we are each dependent upon another and thus responsible for each other and future generations.

LET'S BE ON PURPOSE TOGETHER!



7 PARTNERSHIPS FOR THE GOALS







Corporation