

Carbon Capture and Sequestration (CCS) at scale utilizing Biochar in:

- Construction
- Soil Stabilization
- Pavements & Roads



Let's Go Carbon Net-Negative Together

Nov 2022

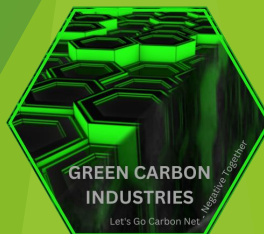


Bringing unique environmentally safe technology to Africa to establish high Carbon Sink & Storage within “Biochar” based roads and construction



A diverse array of Biochars can be used (photo credit Sanjai Parikh)

Let's Go Carbon Net-Negative Together



Introduction

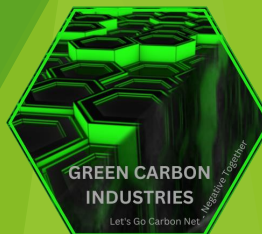
Green Carbon Industries are further developing Environmentally Safe Technologies, @ Scale for applications around circular economic carbon drawdown and storage in a variety of industries centred around both Construction, and Renewable Energy Technologies.

Carbon Sink & Storage (CCS) @ Scale

We have unique capabilities, utilizing natural and environment safe cold emulsion bonding technologies, with high Biochar content across a wide range of construction applications. Our superior penetration bonding mechanisms enable our product installations to achieve “carbon net negative” status due to carbon sequestration at scale (high Biochar content), as well as Green House Gas Emission Avoidance savings towards true carbon drawdown status.

High Permanence and Longer Lasting

Carbon sequestered is stored near indefinitely within an inert road base and various general construction applications, making our products and installations more cost effective per m², easier to use, stronger by an order of magnitude and far safer for the environment if compared to conventional hot asphalt and cement applications.



Our Mission

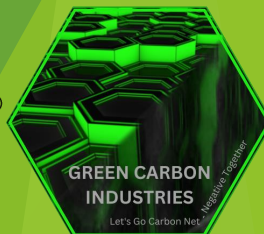
We invite you to join us in our ongoing mission towards making our world Carbon Net-Negative by 2030 and beyond.

We will be a Carbon Capture and Storage (CCS) World Leader

We use sustainable sourced Biochar from biomass and reclaimed waste, our unique emulsions and a wide range of quarry aggregates, soils, gravels and recycled building waste to produce high performance materials containing high concentrations of Biochar towards Carbon Sink at scale.

These higher performance cold mix alternatives to concrete and standard warm or hot mix asphalt pavements are being used as road base, wearing course, and road maintenance applications.

Let's Go Carbon Net-Negative Together



Carbon Net-Zero vs Carbon Net-Negative vs Emission Avoidance and Carbon Abatement

- Explained -

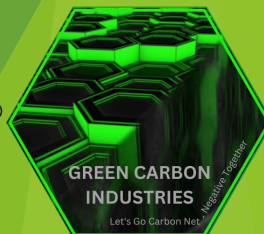


Carbon Net Zero is similar in principle to carbon neutrality but is expanded in scale. To achieve net zero means to go beyond the removal of just carbon emissions. Net zero refers to all greenhouse gases being emitted into the atmosphere, such as methane (CH_4), nitrous oxide (N_2O) and other hydrofluorocarbons.

Being **Carbon Net Negative** means we offset or remove more carbon from the atmosphere than we emit.

Emissions Avoidance or emissions reduction projects are when an activity or project results in future greenhouse gas emissions being avoided or reduced.

Carbon Abatement simply means curbing emissions in order to reduce the concentration of certain gases and contaminants in our environment.

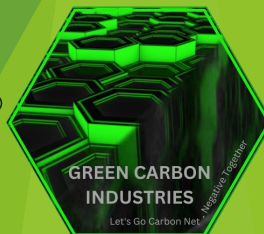


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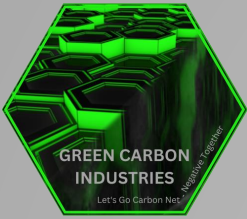
What have we Done? What's Next?

What have we done? We have demonstrated and proved the use of high Biochar concentrations in both urban and rural construction materials worldwide. High performance pavements for heavy duty mine feeder & haul road applications, general road maintenance, overlay repairs and new road installations

What's next? New soil stabilizing applications throughout a wide industry is also in progress, utilizing in-situ soils and gravels, mixed with our unique environment safe emulsion and high concentration of Biochar.



African Alliance in Development



Carbon Sink Accreditation

Modified BioChar Technology

Process R&D

Pyrolysis Technology



Key Raw Materials Control

Production Site Management

Emulsion Technology

Pyrolysis Technology

Pyrolysis Partners

Renewable Energy Partners

Emulsion Plant & mixing Equipment Supply

Production Site Operation Partners

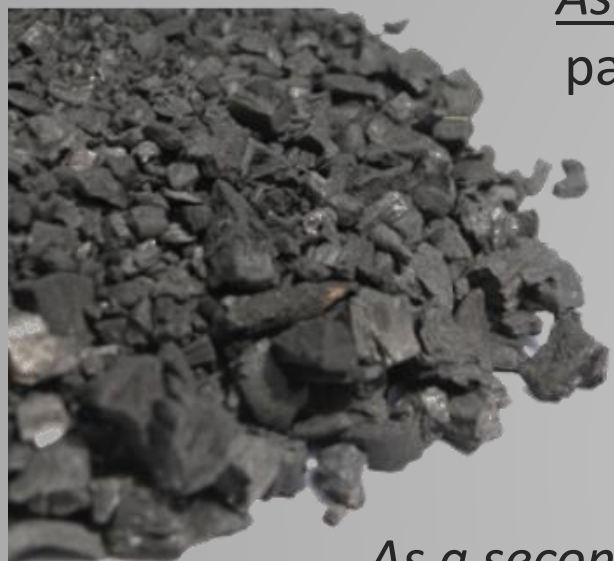
Carbon Sink & Trading Platforms

EIA & EPA Partners or Consultants

Technology Licensing SPV

Biochar for Construction - Specifications

As a first phase, most types of Biochar can be used for the pavement products with general specifications as follows:



Minimum Carbon Content -	40% and higher
Maximum particle size -	6 mm preferred
Maximum moisture content -	35%

As a second phase, further modified Biochar applications will be introduced to include specific PSD mix designs, as well as special products that may include contaminated and partially pyrolyzed char waste and other exotic Biochars by mid 2023 onwards.

By 3rd quarter 2023, there will also be a demand for higher grade fine grinded Biochar.

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Biochar Supply Timeline

While the new Biochar rich pavement material undergoes certification test work, moderate quantities will be required by January of 2023 for Road Repair Maintenance, Forest and Mining Haul Road installations.

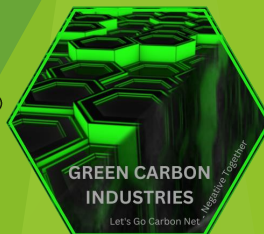
The <6mm fraction of Biochar will be used in the initial roll-out of the standard cold bio asphalt wearing course material, as well as addition to bulk soil stabilization starting spring 2023.

For 2023, the estimated Biochar demand is expected to be ca 10 000 to 15 000 Metric tons. Follow-on demand is estimated to more than double each year for the next 2 - 5 years.



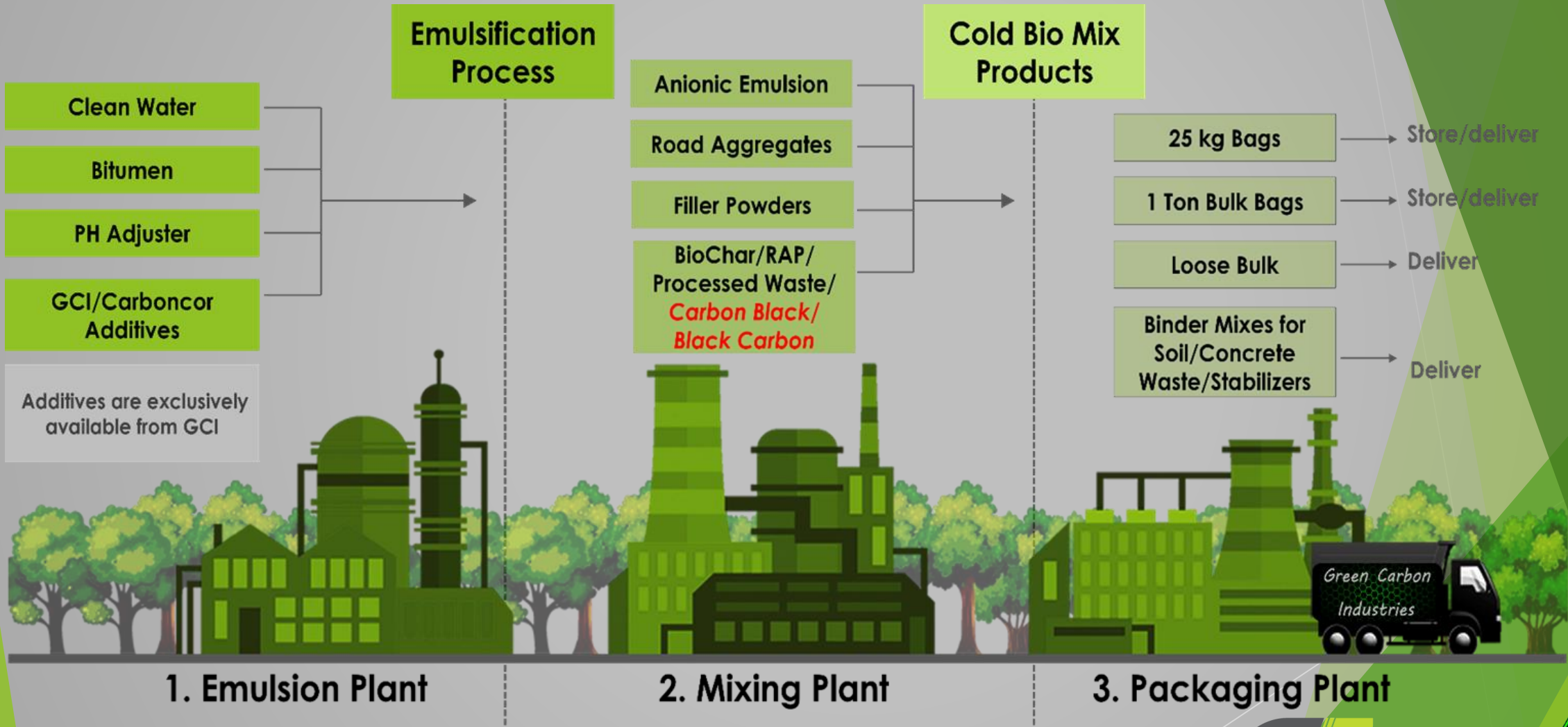
Detailed Preliminary Biochar Specifications

- ◆ Minimum 40% fixed carbon content. (Biochar will generally have a higher value)
- ◆ Particle size max 6 mm.
- ◆ Moisture content of no more than 35%.
- ◆ “Rest” for a period of no less than 5 days before transport.
- ◆ Pass a self heating test at a certified laboratory.
- ◆ Biochar that fails the self heating test must be carried in Specialized bulk packaging.
- ◆ All pyrolysis feedstock must originate no farther than 250 km from the pyrolysis plant.
- ◆ Most types of waste biomass feedstocks are acceptable.
- ◆ Treated or construction & demolition wood feedstock is acceptable.
- ◆ High ash content is generally not a problem.
- ◆ All efforts to maximize CO₂ avoidance and carbon removal credits should be taken to enhance value.
- ◆ Biochar for construction value will be determined by a formula which calculates fixed carbon content permanence, carbon credit value, logistics and Pyrolysis CO₂ footprint.



THE PROCESS

Basic production is completed in a **3 stage** process with between 80 – 99% of the final product sourced from the local market area in the production territory. More than 30% processed waste can be used as raw materials. Even larger quantities of RAP (Reclaimed Road Pavement) can be used.



Additives are exclusively available from GCI



Project Process



What is Biomass?

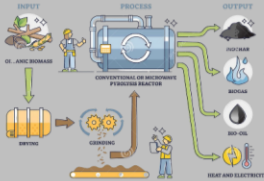
Biomass is a term for all organic material that stems from plants (including algae, trees and crops). Biomass is produced by green plants converting sunlight into plant material through photosynthesis and includes all land- and water-based vegetation, as well as all organic wastes.

- Quarry aggregates
- Local soils and gravel
- Recycled construction waste



Biomass

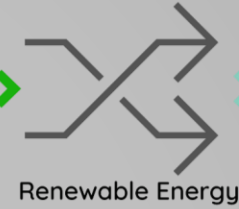
Pyrolysis Plant
Biochar & Char



Volatile Matter

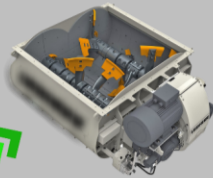


ORC Power



xMW Out

Mixing Plants



Electricity generators



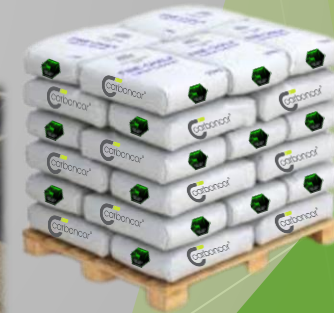
Cold Emulsion Storage



Cold premix
Construction & Repair



- Bulker bag packaging
- DIY installations



Mining Haul Roads

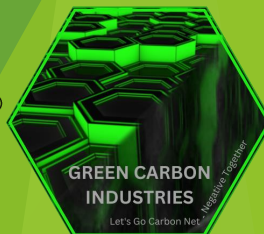
Road Base

Wearing Course

Pavement & Road
Installers/contractors

Soil Stabilization

Maintenance & Repair
Products



What's next?

Our road to a Climate Target by 2030 and Beyond

2022

- Introduce high Biochar Content Environmentally Safe Cold Asphalt to all of Africa
- Further educate partners & customers on the use of Biochar in construction & roads

2023

- Establish relevant lab analysis, certification and endorsement process for Africa

Scale-up of Biochar production on the continent, including awareness of "Waste Material to construction Biochar"

Support & Establish Carbon Sink & Carbon Credit Systems for African producers and consumers

2024

- Onwards – Continue scale-up of Biochar production, and Pavement Carbon Net- Negative applications

Further develop & Introduce larger scale renewable energy recovery technologies from waste materials

2025

- Further develop and introduce non-biomass waste types to pyrolyzed Biochar applications, as well as integrating renewable energy recovery technology on all the site operations

2026 and Beyond

- Supersize renewable energy recovery from waste to construction char worldwide
- Supersize Biochar use throughout all construction applications
- Supersize waste recycling and for optimum circular economy systems

carboncor®



Projects Completed



carboncor[®]



Projects Completed

Cameroon

Vietnam

carboncor®



Projects Completed



carboncor[®]



2 THE PRODUCT

2.1 Carboncor Technology

Uses local road aggregates, carbon-based materials and specifically formulated anionic bituminous emulsion to form a permanent solution for all road use. Its benefits include:

No Cracking



No "Creeping"



No Heat



No Leaching



No Solvents




No Tack Coat



No Waste



carboncor[®]
PRODUCTS



ENVIROMENT
SAFE
ANIONIC
EMULSION

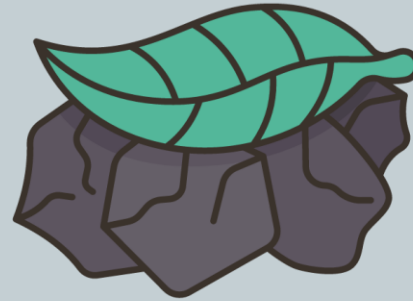


Questions



What is Green Carbon?

The colour of carbon matters.
Green Carbon is the carbon stored in the plants and soil of natural ecosystems and is a vital part of the global carbon cycle



Why use Biochar and Green Carbon?

Use of biochar, sustainably derived from Green Carbon char significantly enhances permanence and superior high duty pavements are proven

If you would you like to know more, please do not hesitate to contact us

Let's Go Carbon Net-Negative Together





THE ROAD TO CERTIFICATION



Resilient Indirect
Tensile Modulus (ITM)

Resilient Modulus on
Unbound Granular
Material

Flexural Beam Modulus

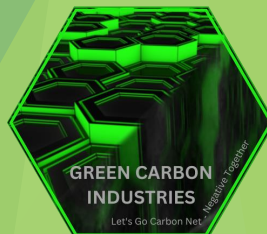
Flexural Beam Fatigue

Wheel tracking (Rut
Resistance)



the dtic

Department:
Trade, Industry and Competition
REPUBLIC OF SOUTH AFRICA



Let's Go Carbon Net-Negative Together

Ongoing Improvement by Carboncor:

Australia and Asia on route

- Use of Biochar sustainably derived from Green Carbon char significantly enhances performance and superior high duty pavements are proven in Australia and countries in Asia.
- Using GCI and Carboncor technology, up to 300 t of Biochar or char sequestered per Kilometre of 2 lane road.
- The binder + Biochar products are also used for military and rural road maintenance (pothole, stabilization, overlays) with high Biochar content.

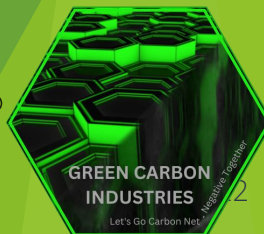
For Africa

- Great opportunity to incorporate Biochar and carbonaceous chars to enhance durability for new pavement construction and road maintenance/repairs.
- Validate and certify the use of local Biochars, bio-coals and chars
- The Carbon Credit certification process for the Biochar rich pavements is on route in Africa already.



THE POSITIVE IMPACT ON CLIMATE

- 70 Mil to 100 Mil tons of Biochar material needed to make environment safe char-based asphalt road mixes for the asphalt roads constructed every year...greatly increased Biochar sales value.
- Biochar from forest clean-up, residuals and from fire damaged wood resources, insect damaged wood and construction and demolition wood can be safely used.
- Carbon is sequestered in the pavements and provides a superior bonding mechanism.
- More conductive and with less layer thickness, this will reduce heat sink effects.
- Reduced installation related emissions and simpler road construction.
- Existing infrastructure and equipment can be used.
- Renewable Energy Recovery during production and converted to sensible heat and converted to power using ORC turbines.
- When technology is verified by SANAS and Roadlab, state adoption can proceed.
- Biochars & chars can also be used in various industries as carbon sink alternatives to reach Global Climate Targets.



EASY TO USE TECHNOLOGY

Road Wearing Course Installations

Step 1: A small % (less than 1% of final mix) Carboncor and GCI additives are used to manufacture a cold anionic emulsion.

Step 2: Standard quarry aggregates are mixed with Biochar and emulsion and has a “on tipper truck” shelf life of up to 2 weeks.

Step 3: Standard road paving equipment is used, with no heat or solvents required.

- Compaction is by way of light weight equipment only, while total time of installation is reduced due to reduced wearing course thickness required. All surfaces must be damp before installation commences, so no extended drying times for road base required.

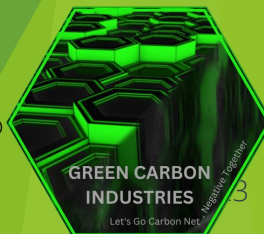
Step 4: Curing within a few hours, depending on weather conditions.

- For low volume roads in a straight line, roads can be opened immediately after compaction.

Road base, Soil Stabilization and Hardstands

Step 1: Use of standard mechanized soil stabilization equipment or mobile twin screw pugmill mixer to mix emulsion + Biochar and local soils and gravels, or recycled waste to create a “Weatherproof” base or subbase layer for roads, factory hardstands, airport runways, slope stabilization and various other applications.

- With the addition of slightly higher concentrates of emulsion, the soil stabilizer layer also serves as a dust and skid free wearing course on remote and rural roads.



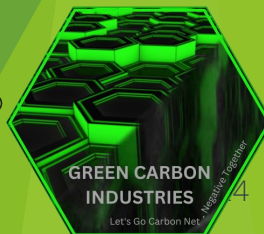
USE OF CHAR AS ASPHALT MODIFIER

- Reduce temperature susceptibility (Cooler Pavement)
- Improve Resilient Modulus (Higher Strength)
- Improve binder performance (Effective Binding)
- Better resistance against oxidative aging (Less Binder Breakdown)
- Develop self-healing/fixing properties in pavement
- Sequester carbon long term in pavement installations (Char stays in mix)
- Obtain environmental credits for emission avoidance, energy savings and long-term carbon sinks



Net Benefit: Stronger pavement, less expensive, longer lasting, and easier installation

TRULY CARBON NET NEGATIVE INSTALLATIONS



Meet Our GCI Team



Andre van Zyl
Founder and Director



Wanda Kasselmann
Business Development
Manager



Anrich van Zyl
Technical Manager



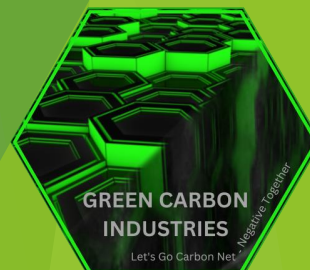
Kay van Zyl
Founder and Director

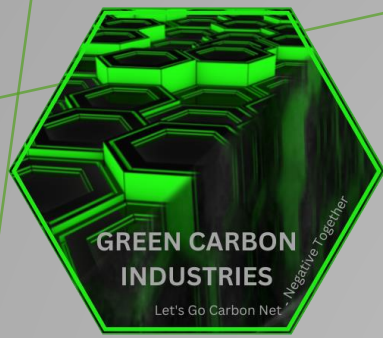


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THANK YOU

