



verenovo.

We manufacture patented scaled technology for a growing bioproducts production industry.

verenovoenergy.com



MICRO
RURAL IMPACT
SEED
Grant Recipient



Wood Innovations Grant
Recipient

The **problem** for our customers.

Waste Producers



Waste with little-to-no value is piling up.

- Expensive to dispose
- Not worth it to sell
- Creates environmental issues

How we address the **problem** for our customers.

Waste Producers



Biochar
Biocarbon
Carbon Black



How we address the **problem** for our customers.

Waste Producers



What is Biochar?

A simple idea. Many forms. Many uses.

Biochar is a carbon-rich material produced by heating biomass in a low-oxygen environment (pyrolysis).

It is stable, porous, and versatile—and its **properties can vary widely** based on feedstock and process.

One material.
A wide range of possibilities.

INDUSTRIAL & ENERGY

- Solid fuel / co-firing
- Gasification feedstock
- Heat and power generation



MATERIALS & MANUFACTURING

- Polymer & composite fillers
- Adsorbents
- Functional materials



METALLURGICAL

- Reductant in metal production
- Lowers emissions
- Improves efficiency



FILTRATION & AIR PURIFICATION

- Removes pollutants
- Odor control
- Air & gas treatment



ENERGY STORAGE

- Electrode materials
- Conductive additives
- Supercapacitors



CHEMICALS & CATALYSIS

- Catalyst support
- Chemical feedstock
- Value-added products



ENVIRONMENTAL REMEDIATION

- Binds heavy metals
- Immobilizes pollutants
- Site restoration



SOIL & AGRICULTURE

- Improves soil health
- Increases water retention
- Supports long-term carbon sequestration



WATER & WASTEWATER

- Adsorbs contaminants
- Improves water quality
- Supports filtration systems



CONSTRUCTION MATERIALS

- Enhances concrete performance
- Improves strength & durability
- Reduces carbon footprint

AN AMBIGUOUS TERM

“Biochar” is a broad term. Its properties depend on:

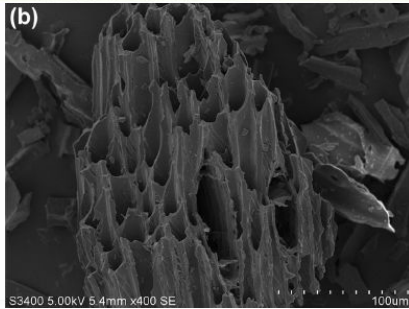
- ✓ Feedstock
- ✓ Pyrolysis temperature
- ✓ Residence time
- ✓ Process conditions

Feedstock Matters: Different Structures, Different Biochars

Biochar retains the anatomical structure of its feedstock, resulting in distinct pore architectures and properties.

SOUTHERN YELLOW PINE

Softwood



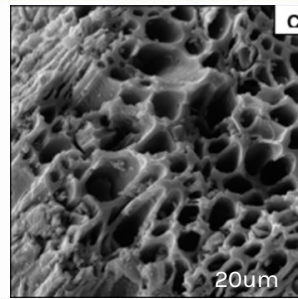
Elongated tracheid cells and bordered pits create long, directional pores.



- High structural order
- Large longitudinal channels
- Lower ash content

WHITE OAK

Hardwood



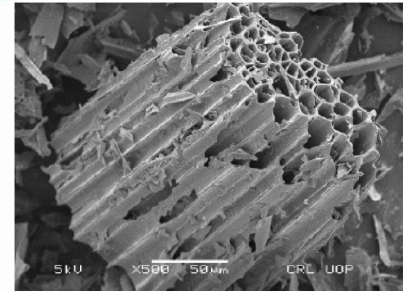
Large vessel elements and rays create heterogeneous, high-macroporosity.



- Prominent vessel pores
- Heterogeneous pore network
- High macroporosity

SUGARCANE

Herbaceous Grass



Thin-walled cells form a honeycomb structure with smaller, more fragmented pores.



- Honeycomb cellular matrix
- Smaller pore diameters
- Higher silica and ash content



Different feedstocks = Different biochar structures = Different performance

Understanding structure helps us design the right biochar for the right application.

Images: SEM micrographs

Sources:

- Ani et al., 2025. *Fuels*, 6(3), 51.
- Carlos et al., 2020. *Fuels*, 280
- Tasim et al., 2019. *Sarhad Jornl of Ag*, 35

Feedstock characteristics influence biochar properties, which in turn impact performance in different end uses.

One Feedstock. Different Temperatures. Different Biochar.

Pyrolysis temperature shapes structure—and performance.

As temperature increases, biochar becomes more porous, carbon-rich, and ordered. These structural changes determine how biochar interacts with the environment and which applications it is best suited for.



Key Takeaway

Biochar is not one material. It is a family of engineered carbon solutions.

PYROLYSIS TEMPERATURE	RAW FEEDSTOCK (Untreated)	300 °C	400 °C	500 °C	600 °C	700 °C
SEM IMAGE (Douglas Fir)						
KEY STRUCTURAL CHARACTERISTICS	<ul style="list-style-type: none"> • High volatile content • Low surface area • High oxygen content • Disordered structure 	<ul style="list-style-type: none"> • Initial pore development • Higher oxygen content • More functional groups • Lower stability 	<ul style="list-style-type: none"> • Increased porosity • More surface area • Moderate carbon content • Good nutrient & water retention 	<ul style="list-style-type: none"> • Higher surface area • Lower oxygen content • More stable structure • Improved adsorption capacity 	<ul style="list-style-type: none"> • Higher fixed carbon • Developing aromaticity • Higher electrical conductivity • Greater stability 	<ul style="list-style-type: none"> • Highly carbon rich • Highly aromatic • Graphitic ordering • Low surface chemistry
APPLICATIONS	Not Applicable (Precursor Stage)	<p>Soil Amendment & Agriculture</p>	<p>Water Filtration & Remediation</p>	<p>Activated Carbon Feedstock</p>	<p>Carbon Credits & Long-Term Sequestration</p>	<p>Graphitic Carbon for Batteries & Metallurgical Uses</p>

Matching the right biochar to the right application unlocks greater environmental and economic value.

Source: Advanced Light Source, Berkeley Lab (2013)
als.lbl.gov/moving-industry-forward-finding-the-environmental-opportunity-in-biochar/

How we address the **problem** for our customers.

Waste Producers



Coking coal



Activated Carbon



Bioconcrete

Graphite Anode



Who buys biochar?

INDUSTRIAL MANUFACTURERS



Agriculture



Steel



Construction



Graphite Production



Water Filtration

Companies in this market are seeking **domestic alternatives** to their **foreign inputs**

Drivers include:

- Carbon smart alternatives
- Tariff proof supply chains
- Environmental stewardship
- Customer demand

Customers seek high-performance biocarbon products





Verenovo's Patented Technology



HIGHEST AND BEST
VALUE FROM INPUT
MATERIAL

ON THE FLY
ADJUSTMENTS AND
MAINTENANCE

Base Unit System Specs

Biomass	3-4 tons per hour	Modular Configuration
Carbon	1600-2000 lbs per hour	~93% Fixed C <3% ash
Energy	13 MMBtu.hr	Genset, CHP, etc
Syngas Flow	~20,000 scfh based on MW	6in Water Column Pressure
Footprint	340 X 225 ft ²	Includes material handling
Continuous - No thermal oxidizer - Low Parasitic Load		

Key Benefits

- **5MW:** Energy production potential with biomass (*more with petroleum derived waste material*)
- **Patented design:** Enabling precise quality control
- **US Manufacturing:** Stateside supply chain, rapid deployment



Revenue Optimization



Feedstock

16,000
tons/unit/year



Equipment

MSRP \$2M



Biochar

Low \$350/ton
High \$2000/ton



Carbon Credits

\$150/credit
2.8 credits/ton



Energy

5MW



MARKET POTENTIAL

Market Categories for Carbon Product



Verenovo biochar exceeds **metallurgical** demands.

	Verenovo Biochar Specs	Steel Manufacturer Requested Specs
Biochar size	<10mm	<30mm
Shape	Irregular, porous	Fine and lumpy
Bulk Density	900 kg/m ³	As high as possible for finished product
Moisture	<4%	<15%
Fixed C	93%	>90%
Volatiles	<5%	Max 10%
P Content	<250 mg/kg	Max 300 mg/kg
S Content	291 ppm (0.029%)	Max 500 mg/kg



The **economic case** for biocoke.

Component	Conventional Coking Coal	Biocoke (Low-Carbon Substitute)
Current Spot Price (per tonne)	\$204	\$450
CO2 Emissions (t CO2/t coal)	~2.9	~0
Carbon Penalty (EU ETS @ \$98.5/t)	~\$285.65	\$0
Effective Cost (w/ emissions)	~\$489.65	\$450
Net Savings Potential	–	\$35.65/tonne

800 Million tons of coking coal used annually

Biochar is one of the **most scalable climate solutions** available for the construction industry today.

2025



The power of biochar: Our breakthrough carbon sink tech explained



What We're Doing

Advancing research & trials for biochar in concrete, cement & mortar

Transforming buildings into carbon sinks

Improving performance & aesthetics of materials



Why It Matters

Helps data centers & infrastructure cut carbon footprints

Provides sustainable alternatives for builders

Validated globally (e.g., Holcim's Venice Biennale project)



Impact Potential

Each kg of biochar sequesters ~3 kg of CO₂

Supports circular economy via waste-to-value conversion

IPCC: up to 2.6B tons CO₂ removal annually (~565M cars off the road)




Biochar as a precursor to **activated carbon.**

- **Simpler pathway:** Biochar is already carbonized → only activation (steam/CO₂ or chemical) needed
- **Proven performance:** Wood/biochar precursors deliver high surface area, adsorption comparable to coal-based AC
- **Techno-economic potential:** TEAs show activating biochar improves product value; competitive with coal AC
- **Lower footprint:** LCA shows ~39% lower cumulative energy demand vs. coal-derived AC
- **Market relevance:** AC markets (water, air, industrial) are expanding; biochar-to-AC routes align with sustainability goals





Minimum selling price (MSP) of biographite is ~\$3.3/kg or **\$3,300 per ton**. MSP for fossil based graphite is **\$4,200/ton**. 

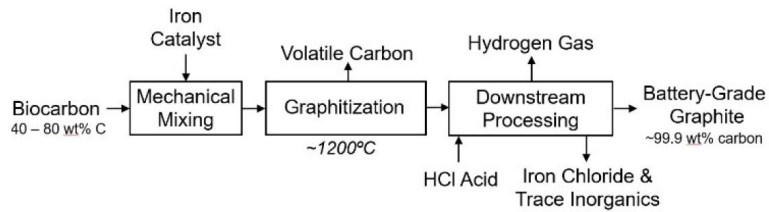


Figure 7. Process flow diagram of catalyzed graphitization of biomass where the final step, downstream processing, involves necessary purification, milling, shaping and coating.



The **benefits** of biochar in agriculture.



Water Retention

average of 45% increase



Nutrient Retention

average of 18% increase



Increased Crop Yield

10+% increase



Reduced Fertilizer Use

20-50% reduction

BIOCHAR CARBON REMOVAL HAS MOVED FROM PILOT TO COMMERCIAL SCALE

Over 3 million tonnes of biochar carbon removal contracted globally with major buyers across technology, finance, insurance, and energy.

TOP BIOCHAR CARBON CREDIT PURCHASERS (PUBLICLY ANNOUNCED)

BUYER	YEARS ACTIVE	TOTAL ANNOUNCED BIOCHAR PURCHASES (tCO ₂ e)	ESTIMATED CONTRACT VALUE*	
			AT \$125/tCO ₂ e	AT \$175/tCO ₂ e
 Microsoft	2023–2026	~1,400,000+	\$175M+	\$245M+
 Altitude Carbon	2025–2026	~1,440,000	\$180M	\$250M
 Google	2025	~200,000	\$25M	\$35M
 Swiss Re	2024	70,000	\$9M	\$12M
 Shell	2024	22,500	\$3M	\$4M
 JPMORGAN CHASE & CO.	2022–2026	9,000+	\$1M	\$2M

*Estimated using published biochar CDR market pricing of \$125–\$175 per tCO₂e. Individual contract pricing is confidential and varies based on project risk, delivery terms, and vintage.



3.0+ MILLION tCO₂e

Biochar carbon removal contracted globally (2022–mid 2026)¹



683,000+ tCO₂e

Delivered to date¹



330,000+ tCO₂e

Retired to date¹



BIOCHAR = LARGEST

Durable CDR category by volume¹

¹ Source: CDR.fyi Biochar Market Snapshot (H1 2025)

BIOCHAR CARBON REMOVAL PRICING (MARKET RANGE)



Forward / Pre-Sold Credits

- ✓ Typical range: \$125 - \$175 / tCO₂e
- ✓ Purchased before delivery
- ✓ Supports project financing



Delivered / Issued Credits

- ✓ Typical range: \$175 - \$250+ / tCO₂e
- ✓ Lower project risk
- ✓ Immediate retirement possible

Individual contract pricing is generally confidential.



KEY TAKEAWAY

Corporate buyers are already committing hundreds of millions of dollars to biochar carbon removal.

THE CHALLENGE IS NO LONGER DEMAND, BUT THE DEPLOYMENT OF HIGH-QUALITY PRODUCTION CAPACITY.

Landowners Are Positioned at the Beginning of the Value Chain



Carbon Removal



Construction Materials



Water Treatment



Metallurgical Carbon



Energy Products



Advanced Materials



The greatest opportunity may not be producing biochar.

It may be **owning and controlling the feedstock** that future bioeconomy industries depend on.



This concept isn't new, it's just shifting focus to other end products. As these markets mature, we will see the scaling and stabilization.



West Virginia Has Assets Many Markets Need



FOREST RESOURCES

- Underutilized fiber
- Forest health projects
- Residual biomass



LEGACY INDUSTRIAL SITES

- Former coal infrastructure
- Rail access
- Carbon removal potential
- Reclamation opportunities



CHALLENGES THAT NEED SOLUTIONS

- Down pulp and paper markets
- Industry downturns like coal and mining

(Coal generation in the PJM grid has fallen from 56% of total generation in 2005 to between 14% and 18% in recent years)



These challenges are real.

They also create a window for new industries that value what West Virginia has.



The transition is already underway.

The assets, infrastructure, and know-how are already here.



Many emerging carbon-negative industries need exactly the assets West Virginia already possesses.



Some of Tomorrow's Opportunities May Start on Yesterday's Coal Fields

Turning legacy lands into engines for restoration, industry, and rural prosperity.



Biochar remediates abandoned mine lands (AML) in West Virginia by neutralizing soil acidity, binding heavy metals, decreasing toxic chemical concentrations, and improving water retention to allow vegetation to establish. State and federal policies offer significant financial and tax incentives to support these reclamation and biochar production projects.

 WV AML Pilot Program
dep.wv.gov/dlr/aml

 WV SB 893 (2026)
wvlegislature.gov/bill_status

 WV Senate News
therealwv.com



Strong Policy Support

Corporate Net Income Tax Credit

To incentivize companies to build operations in the state, qualified biochar facilities can claim a state corporate net income tax credit equal to **10%** of any federal biochar carbon sequestration credit.

Limits

This credit may offset up to **50%** of the taxpayer's state income tax liability and can be carried back to offset previous years.



These incentives are designed to unlock private investment, accelerate land restoration, and drive new economic activity in West Virginia.

Opportunities



Soil rebuilding



Reforestation support



Carbon removal



New revenue streams



Industrial redevelopment



Biochar is one tool among many that may help unlock additional value from lands that have historically been difficult to restore or redevelop.



Questions Every Large Landowner Should Be Asking



What biomass resources do we control today?



Are there underutilized residual streams on our properties?



Could carbon markets create additional value?



Are there reclamation projects that could benefit from biochar?



Which emerging industries may want access to our land, fiber, or infrastructure?



Whether biochar becomes part of your strategy or not, the broader trend is clear. Markets are increasingly placing value on carbon, forest resources, land stewardship, and circular use of biomass. Organizations that understand those shifts early will be better positioned to benefit from them.

Questions?



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