

# Biochar from Quonset Soil Solutions

## Ancient Wisdom + Modern Technology

- Improve Soil & Crops
- Weather Drought Conditions
- Sequester Atmospheric CO<sub>2</sub>



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VP of Business Development





# Why Biochar?

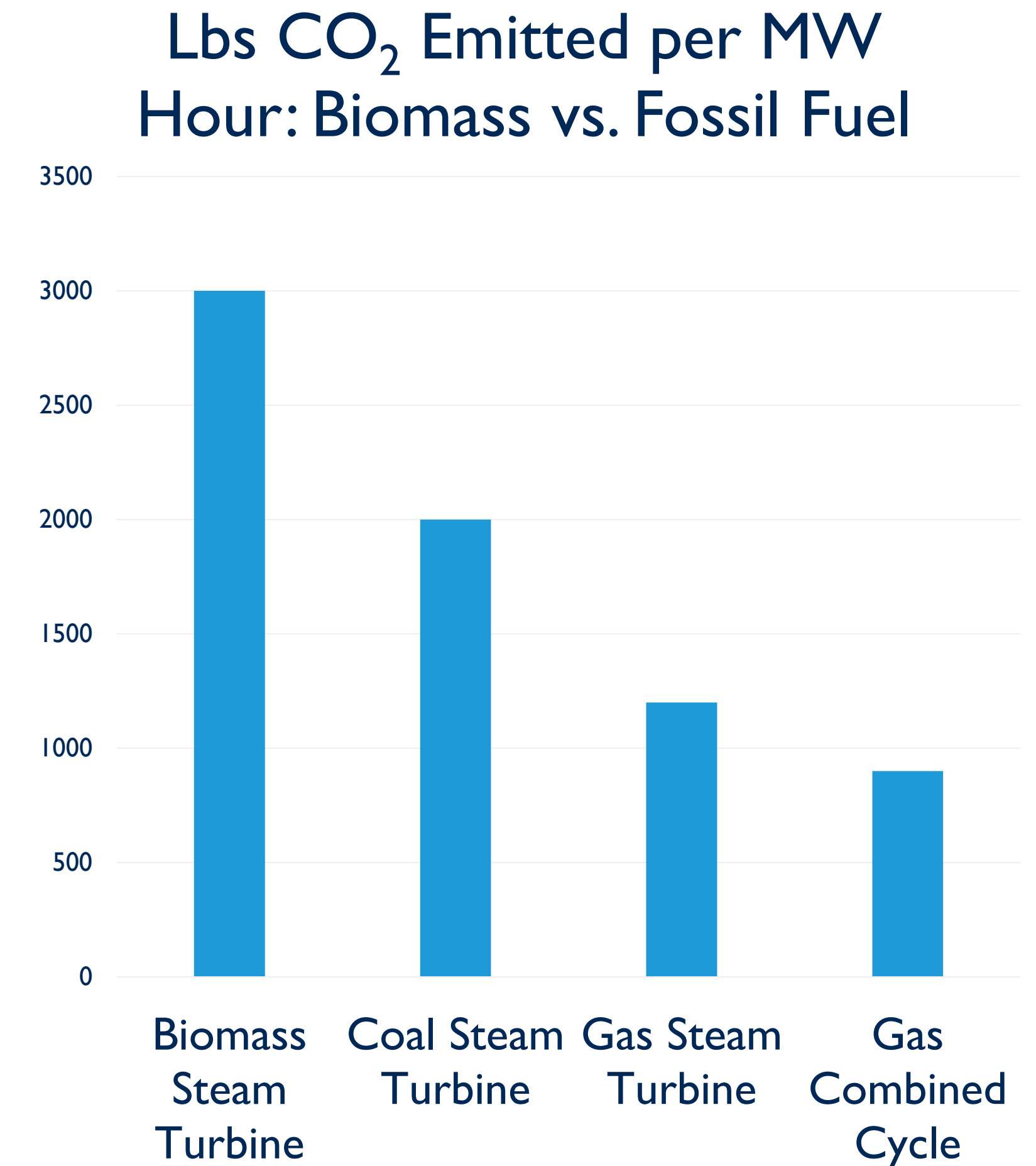
- Green Development's forestry division has been providing services to organizations & property owners in RI & surrounding states for the past several years.
- Options for disposing of clean forestry by-products are limited in RI.
- Green sees its QSS affiliate as an opportunity to become a full participant in the circular economy.
- The new facility will be powered by both on-site & off-site renewable energy solar energy & the excess energy generated by the biochar process



# The Big Problem With Forestry By-Products

Green Development Has Historically Shipped These Materials to a Biomass Plant in Plainfield, CT

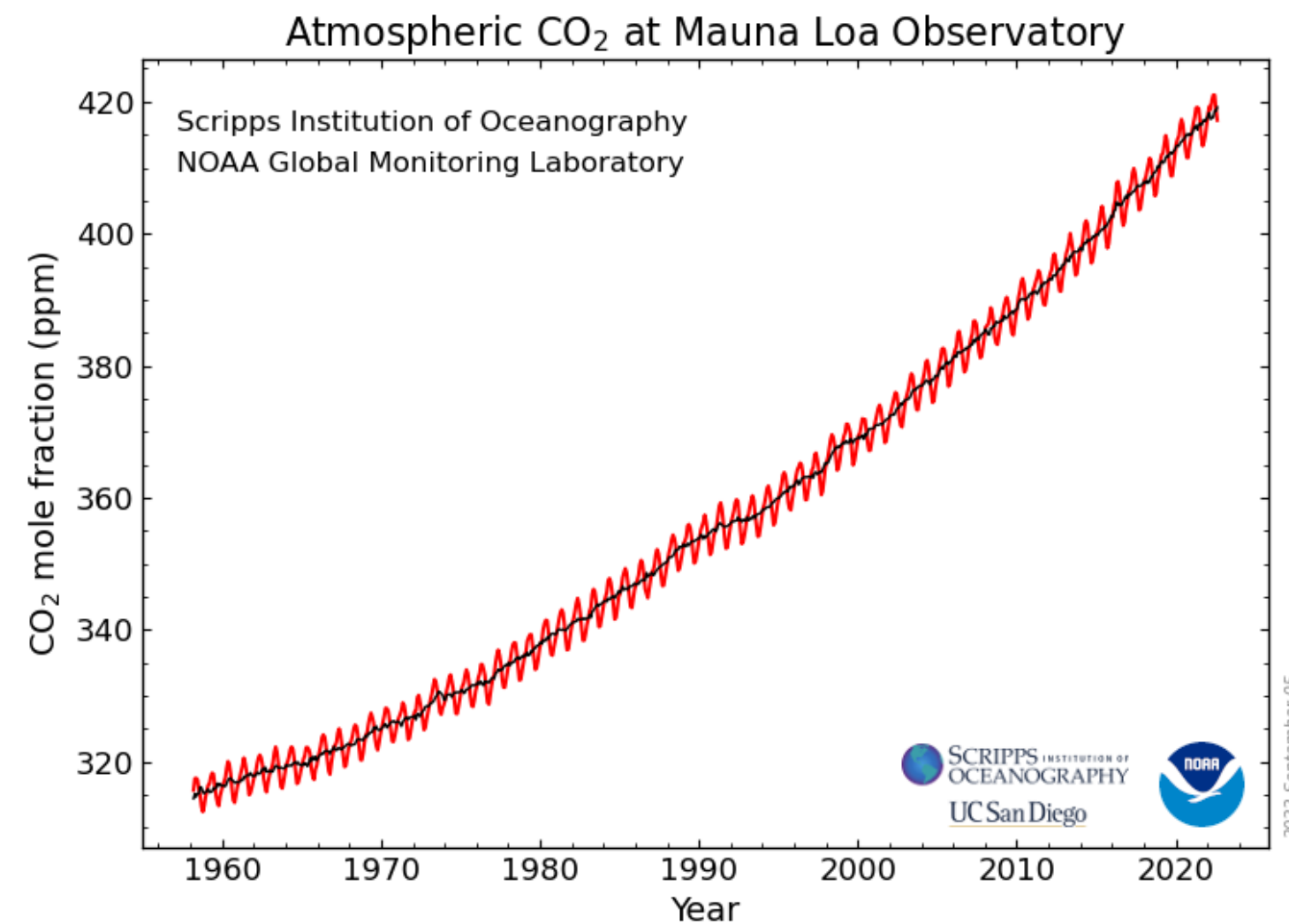
- Wood chips and other forestry by-products are typically shipped to biomass plants or landfills.
- Our mission since 2009 has been about helping to transform the energy mix in the Northeast.
- Biochar is a better use of forestry by-products: Up-cycling a carbon-emitting component of our operations to a carbon-negative product that sequesters carbon.
- Biochar is processed in the absence of oxygen and is in high demand across a wide range of industries.





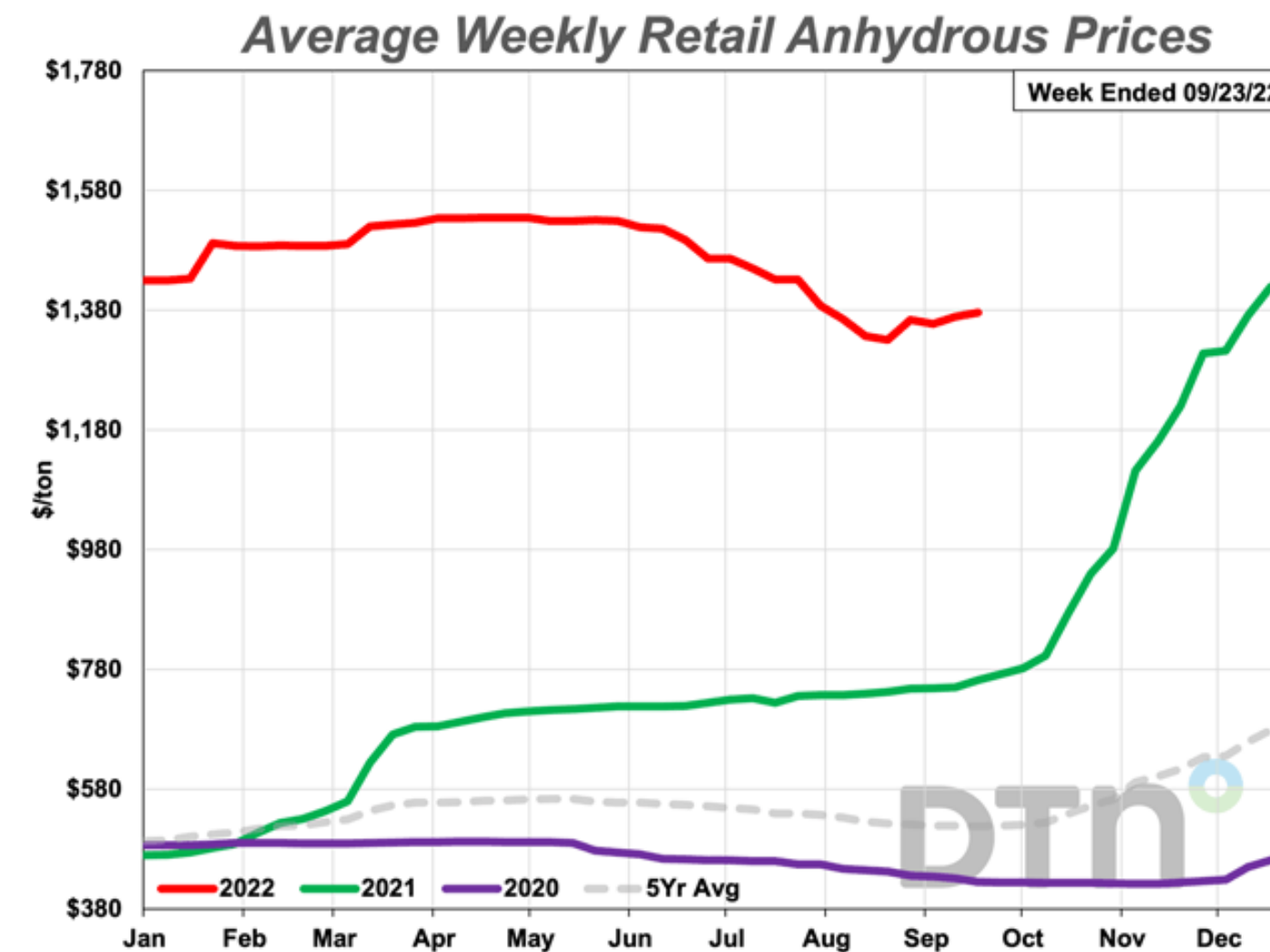
# Additional Concerns Addressed by Biochar

## #1 Atmospheric CO<sub>2</sub> Levels



Level of CO<sub>2</sub> in the Earth's atmosphere is currently the **highest in 14 million years.**

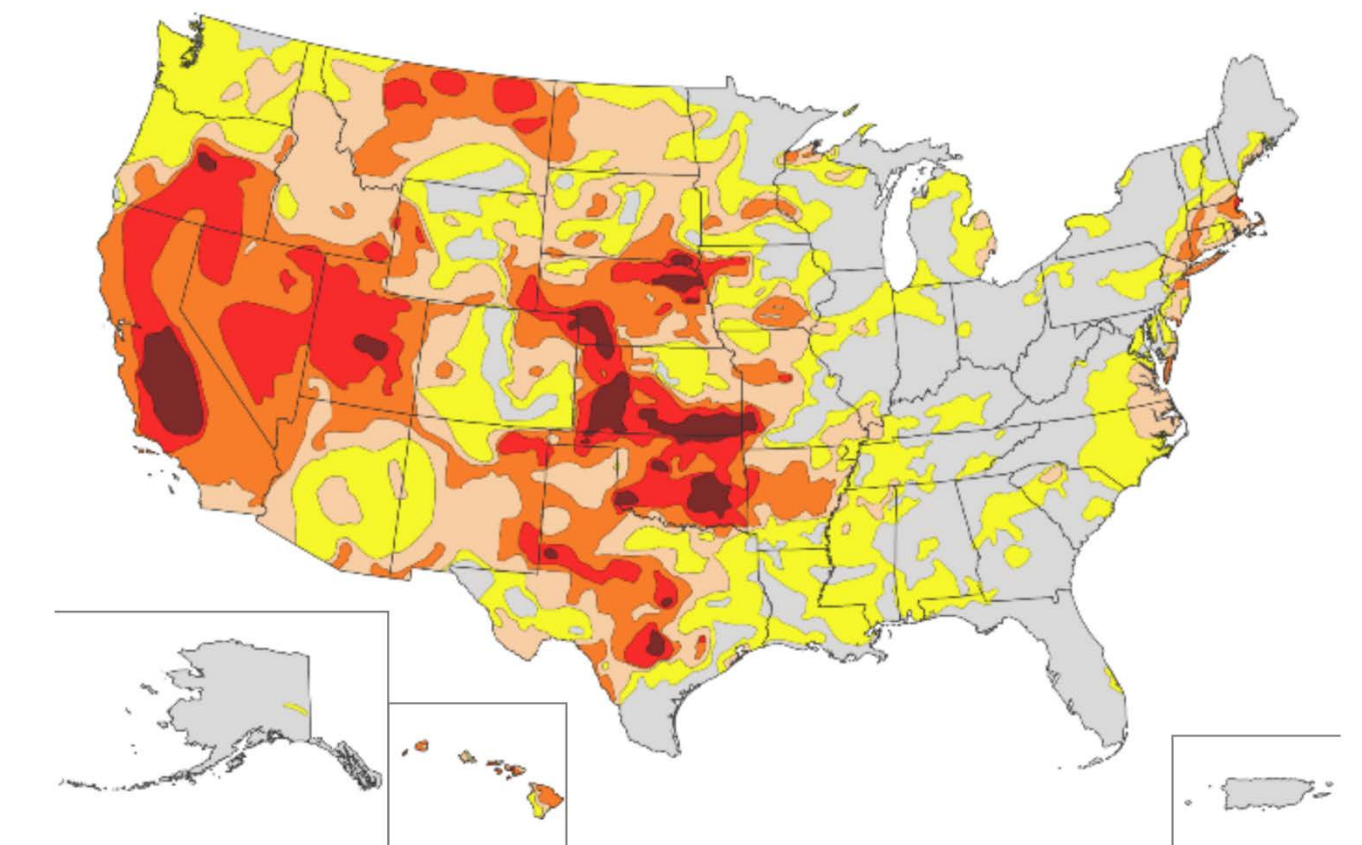
## #2 Rising Fertilizer Prices



Prices of some widely-used fertilizers have **nearly doubled.**

## #3 Abnormally Dry Conditions (12% of NE)

### U.S. Drought Monitor



# Biochar as a Solution

Carbon Sequestration • Soil Amendment • Decreased Watering Needs





# What it is & How it is Made

What is Biochar & How is it Made?

## What It Is

- A black, carbon-dense material produced from pyrolysis of a biomass
- Biomass is organic matter. One example is clean forestry by-products, like wood chips
- High porosity, large surface area & potential to sequester carbon for thousands of years



## How It's Made

- Pyrolysis: A thermochemical transformation at high temperatures in the absence of oxygen
- Baked at 500°C – 900°C
- By products are stable char and gas





# The Process

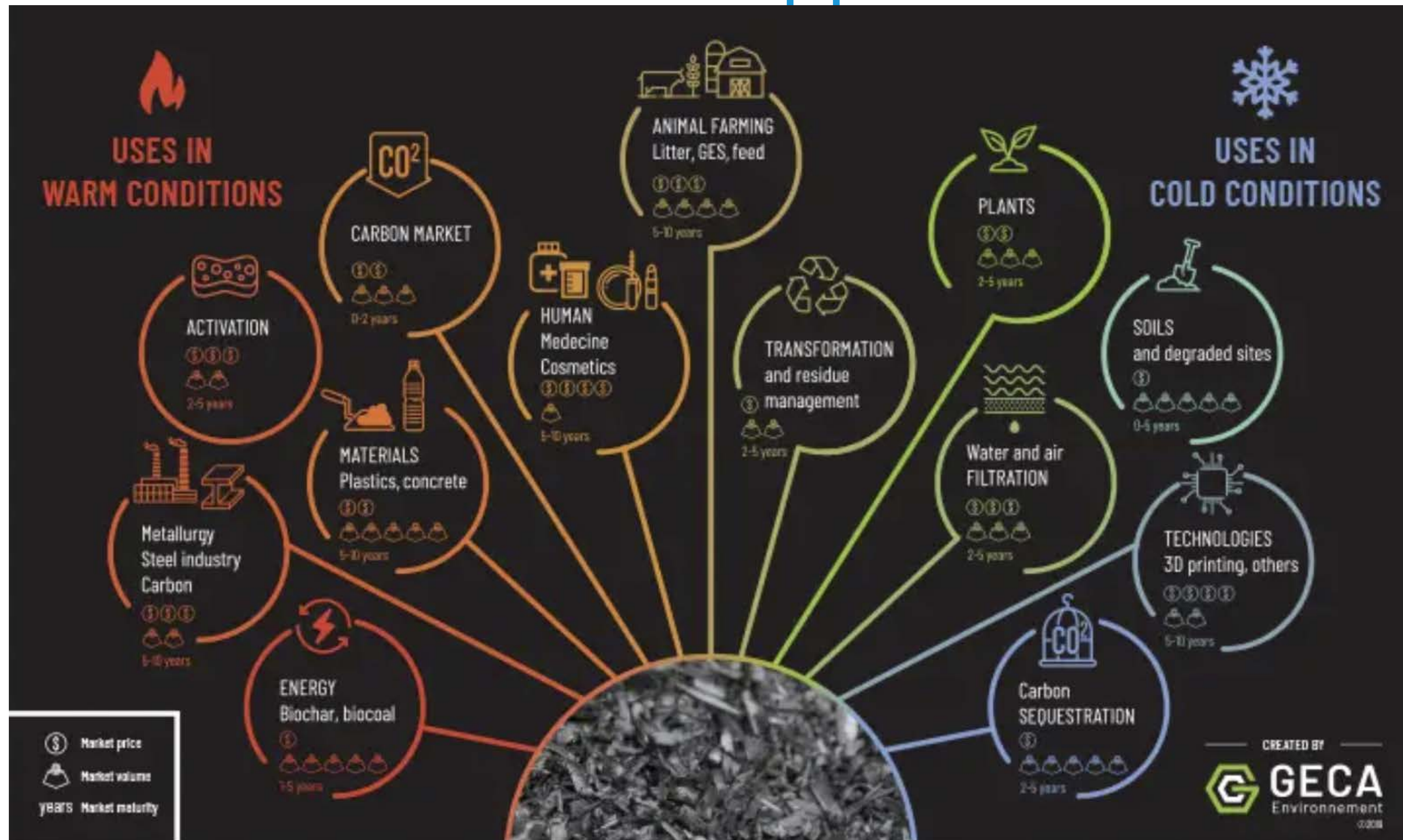
## How it works

- Like baking a cake
- Temperature and time
- Controlled conditions
- Conditions depend on the ingredients
- No oxygen = no combustion





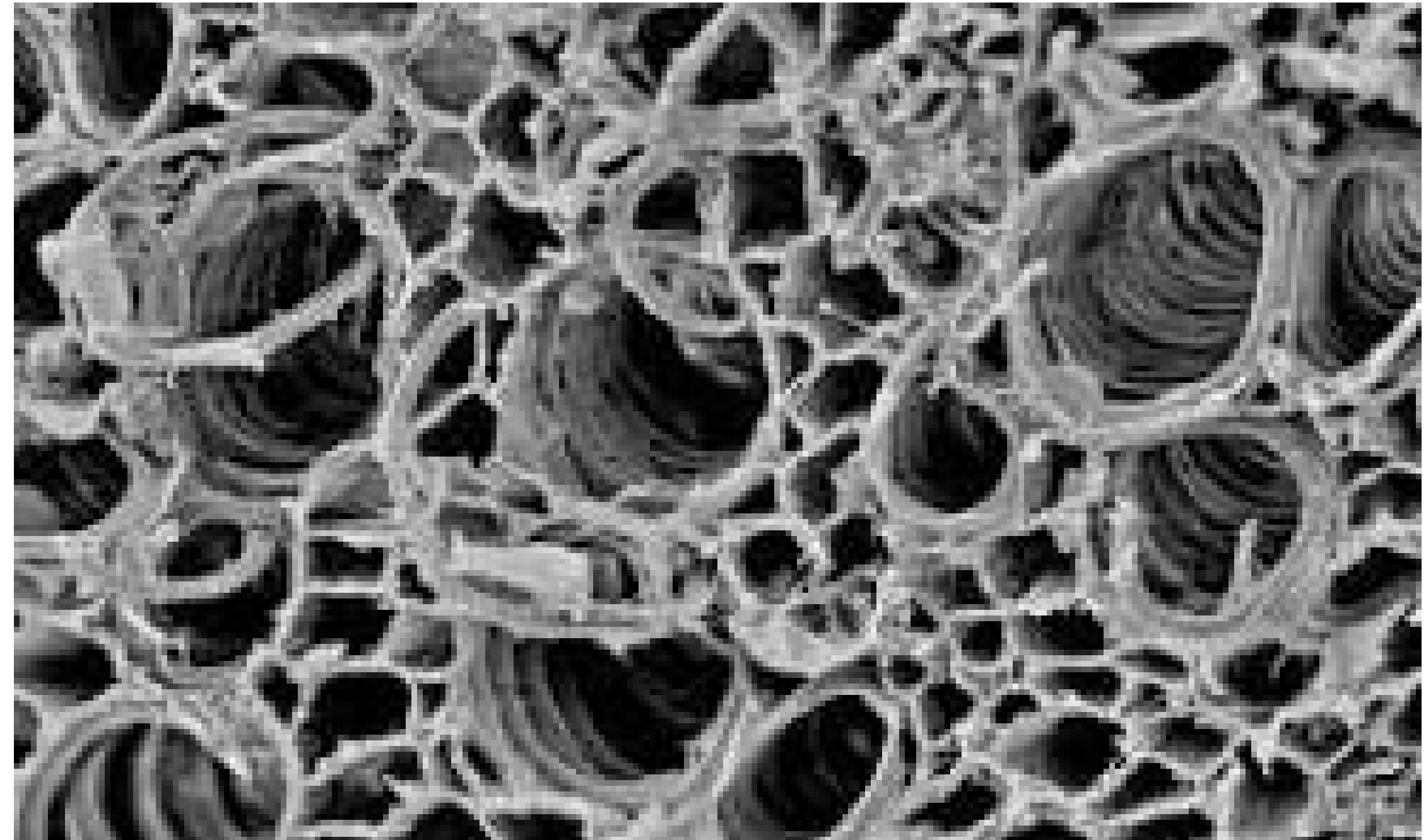
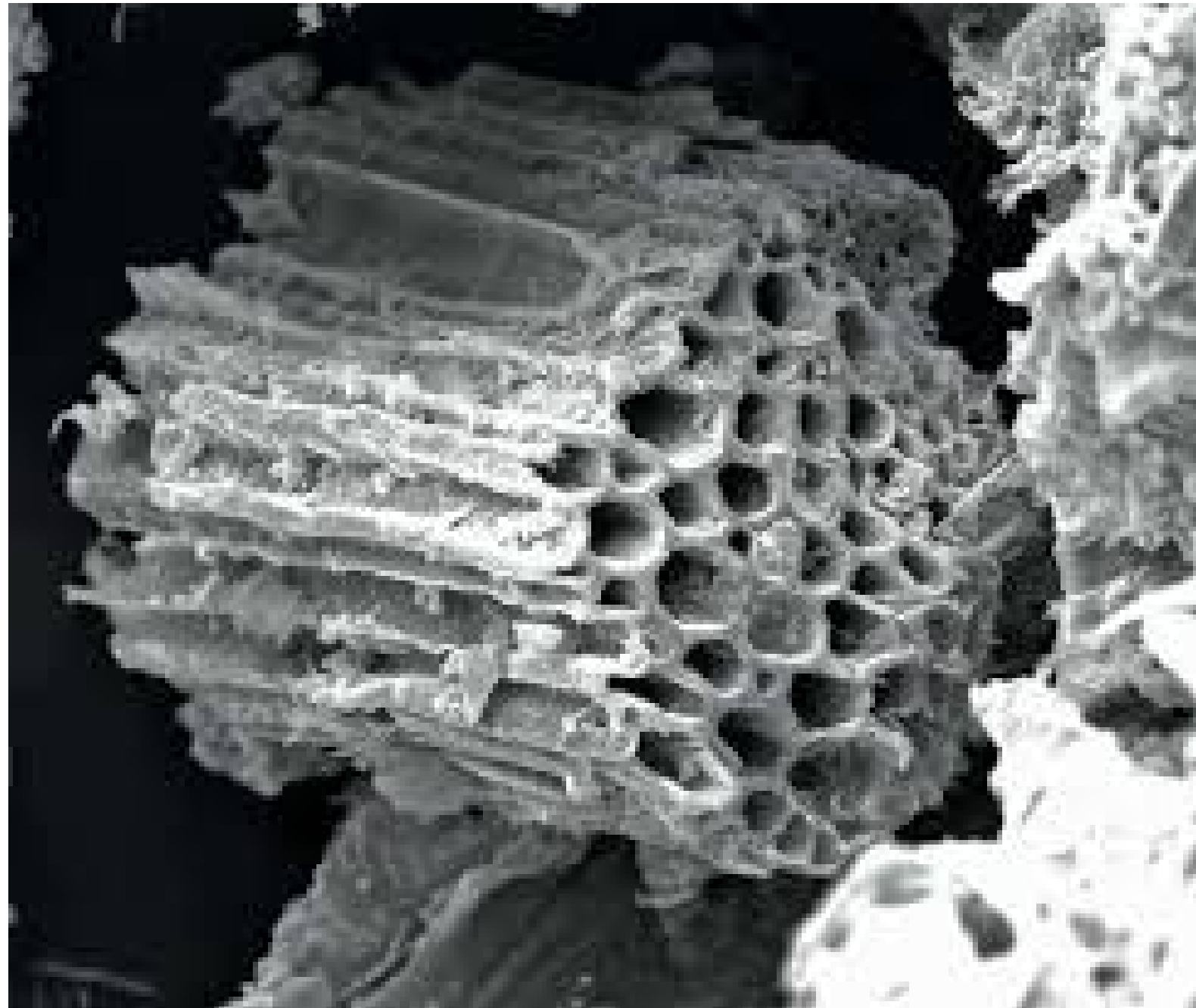
# Biochar Market Applications





# Large Capacity to Store Water & Nutrients

A Few Ounces Has Surface Area of a Football Field





# Benefits of Adding Biochar to Compost

US Biochar Research Study



- Speeds up the composting process by 20% through better aeration of the pile and increasing microbial activity
- Captures odors
- Generates a compost with higher nutrients because biochar retains nitrogen



# Biochar Trials & Adoption

Examples of Successful Applications Across a Few Key Market Sectors



- [Oasis Vineyard Trials](#) (2016-24, Pacific Biochar)
  - 35% higher fruit & wine yields with biochar+compost blend
- [Remediation of PFAS-contaminated](#) agricultural soil
  - Initiated in July 2024 in Unity, Maine (Standard Biocarbon)
- Corn trials across extreme drought & rainy conditions
  - [Multi-year trial in S. Korea](#) saw grain yield increase by 18.5%
- Asphalt additive to replace fossil fuel derivatives
  - All-season cold process has [industry approval](#) (Verde, Sept 2024)



# Trial 1 – Beans – Year 2

- Plants grown in 0c, ¼ c, ½ c, ¾ c, 1 c biochar per cubic foot of soilless growing medium
- Harvested weights indicate that ½ c and ¾c have the highest yields while 1 cup showed a significant yield reduction.



Amount of Biochar (cups)	Total Weight (lbs.)
0	8.66
¼	9.57
½	10.93
¾	11.2
1	4.79



# Trial 5 – Tomatoes - Year 1

- Tomato plants grown in 0c, 1/4c, 1/2c, 3/4c, 1c of biochar per cubic foot of soilless growing medium
- Observations:
  - Better color in biochar plants
  - Shorter internode space in biochar plants
  - Heavier fruit set in biochar plants
  - Decreased amount of B grade tomatoes in biochar groups
  - Fertilizer increased later than in non-biochar plants.



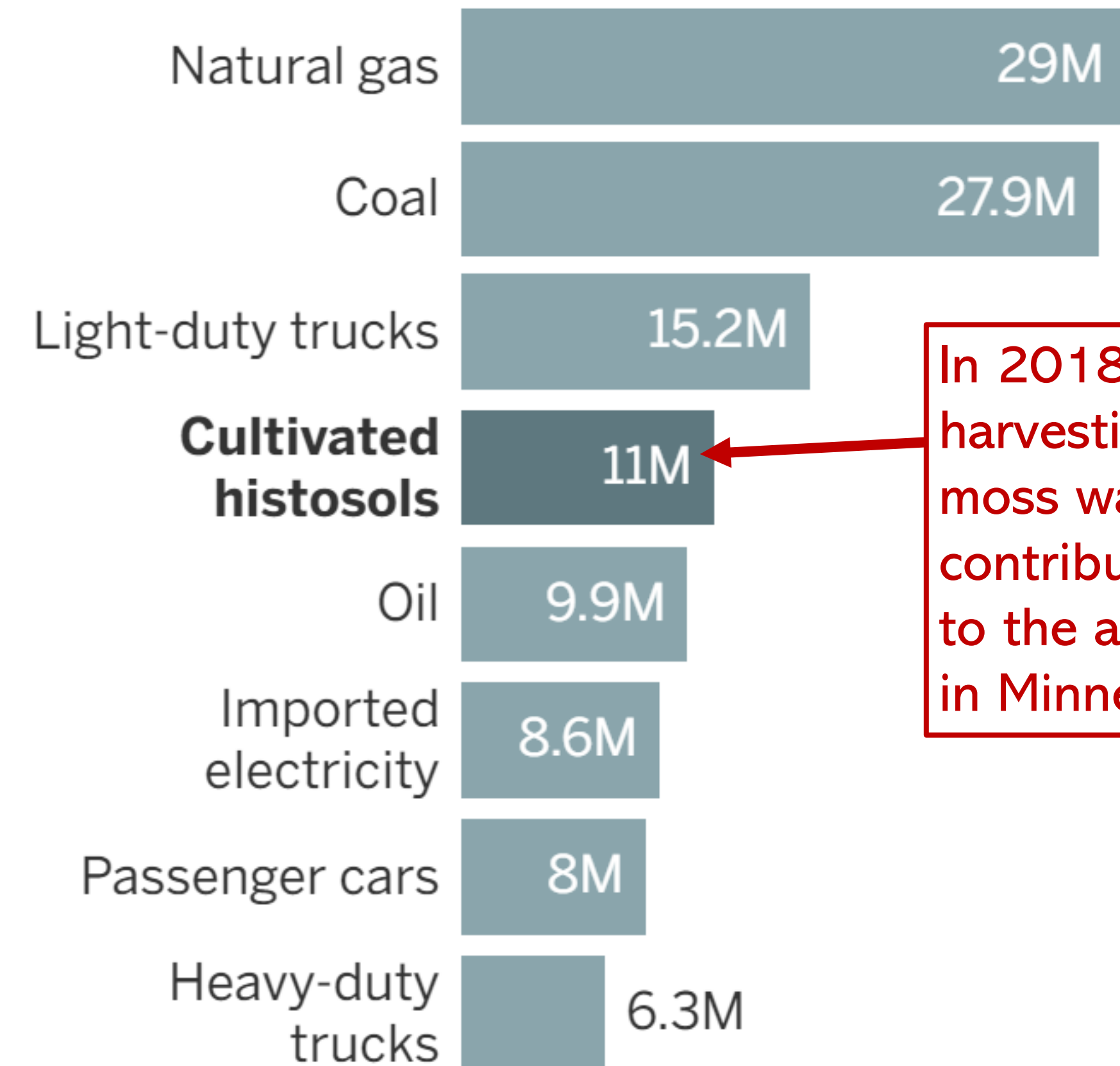


# Indirect Competition

(What Biochar Can Replace)

- **Peat moss**, which releases previously-stored CO<sub>2</sub> into the atmosphere when harvested
- **Perlite**, derived from volcanic glass, open-pit mined in CA or Greece, high-heat-treated, and in short supply in 2022
- **Vermiculite**, derived from a mineral, open-pit mined mostly in South Africa, high-heat-treated, and also in short supply in 2022. It has the potential to retain too much water

## 2018 MINNESOTA GREENHOUSE GAS EMISSIONS IN CO<sub>2</sub>-EQUIVALENT TONS



In 2018, the harvesting of peat moss was the #4 contributor of CO<sub>2</sub> to the atmosphere in Minnesota.

*Total emissions across all industries and all greenhouse gases.*

C.J. Sinner, Star Tribune • Source: Minnesota Pollution Control Agency



# Not All Biochar Created Equal

Source & process dictate characteristics and best applications for the biochar

Carbonization

300°C – 800°C

Pyrolysis

Conventional Charcoal



Open Burning



Gasification Furnace



Fast & Slow Pyrolysis



- Difficult for microbes to thrive with random molecular structure
- Higher ash content, high emissions
- Well suited as a fuel source, arsenic absorbent & bioremediation

- Stable structure with pores for slow-release microbial acidity
- Lower ash content, lower emissions
- Well-suited as a soil amendment, filtration material & compost catalyst



# Resources Biochar News & Education

- **US Biochar Initiative** Learning Center: [biochar-us.org/welcome-biochar-learning-center](https://biochar-us.org/welcome-biochar-learning-center)
- **International Biochar Initiative** Resource Center: [biochar-international.org/resources](https://biochar-international.org/resources)
- **Biochar for Environmental Management – Science, Technology, and Implementation** *by Johannes Lehmann and Stephen Joseph (eds.)*







**QUONSET**  
soil solutions

Please call or write to us with questions or suggestions. We would love to hear from you!

Thank You.

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