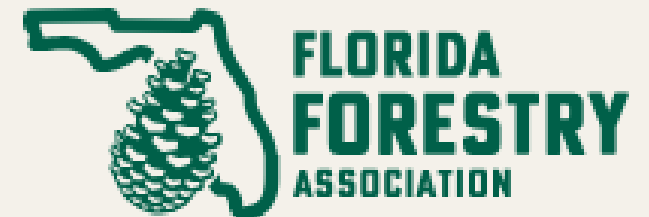


# Biochar - The World's Oldest Emerging Market



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# WHAT IS BIOCHAR?

Highly porous, stable, high carbon material produced by heating organic material in an oxygen-free environment.

## HISTORY OF BIOCHAR

- Production first began at least 2,500 years ago in the Amazon Basin by Indigenous populations mixing charred material into naturally nutrient poor soil “Terra Preta”.
- 19<sup>th</sup> Century: European chemists found that charcoal aided agriculture by retaining nitrogen and nutrients prompting widespread use in Europe and North America
- 20<sup>th</sup> Century: Use declined with industrial production of synthetic fertilizers.
- 2000s – Present: The term “biochar” was coined and use accelerated with production technology development and use for carbon sequestration and industrial applications, many continuing to emerge.



# HOW IS BIOCHAR PRODUCED?

## High Temperature Slow Pyrolysis

- Moderate temperatures (400°C -700°C) & long duration
- Favors solids (biochar) production 30%-50% dry yield
- Primarily in rotary kilns and auger screw reactors

## Fast Pyrolysis

- Higher temperatures (500°C -1,000°C) for only a few seconds
- Favors liquid (bio-oil) yields up to 75% with decreased char yields
- Typically, in fluidized bed reactors

## Gasification

- Temperatures well above 800°C with trace oxygen levels
- Favors yield of syngas and very high fixed carbon at decreased yields
- Fixed bed and downdraft gasifiers



# Numerous Manufacturers of Packaged Production Systems



## FEEDSTOCKS

- **Woody Biomass\***
- **Sugarcane Bagasse**
- **Rice Straw & Hulls**
- **Nut Shells**
- **Crop Residues**
- **Biosolids**
- **Manure**

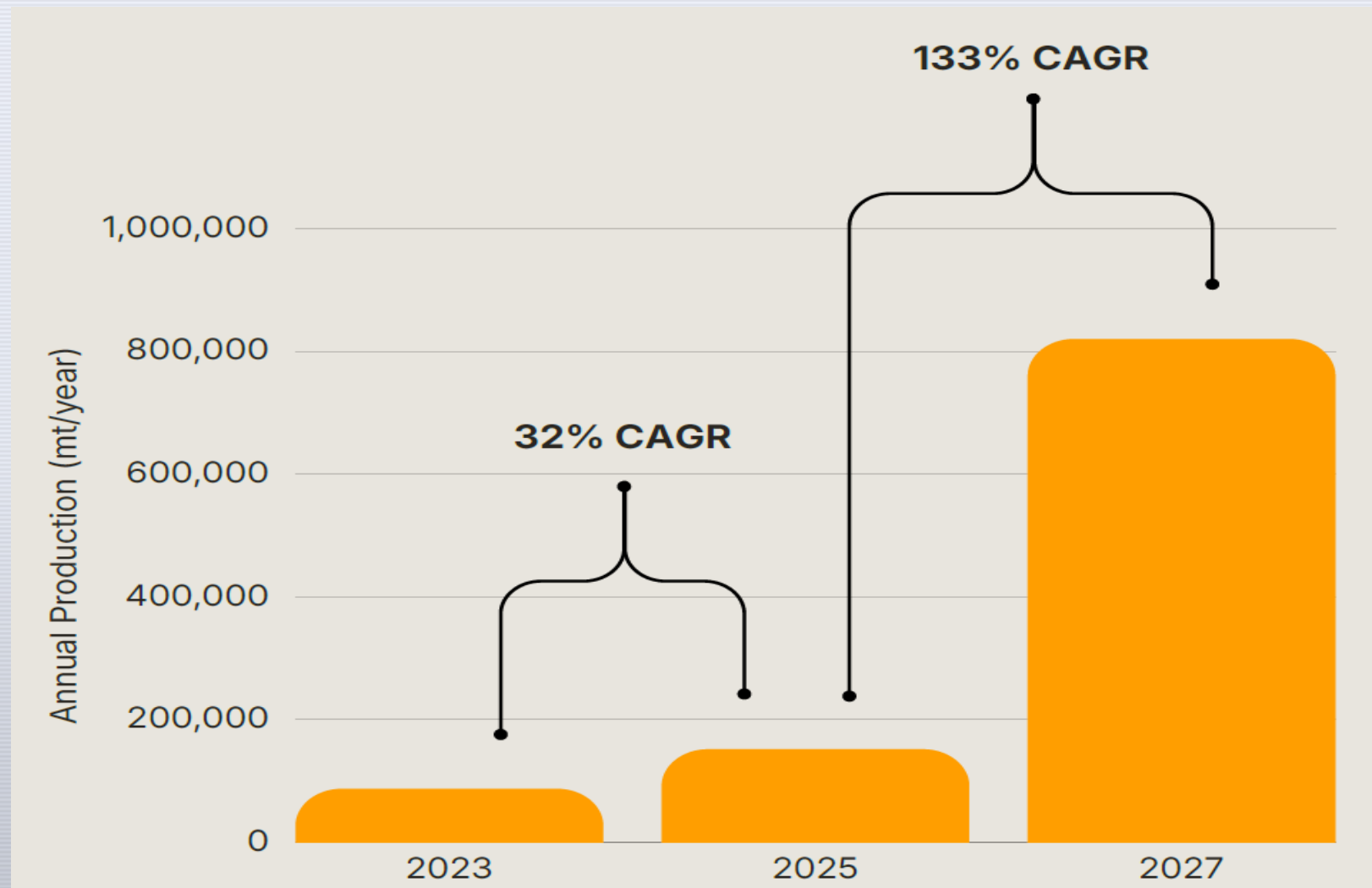
\* Helps support sustainable forestry and forest products producers

## APPLICATIONS

- **Soil Amendment**
- **Carbon Sequestration**
- **Water & Air Filtration**
- **Remediation**
- **Industrial Products**
  - **Cement**
  - **Asphalt**
  - **Steel**

***More emerging all the time!***

# BIOCHAR PRODUCTION GROWTH

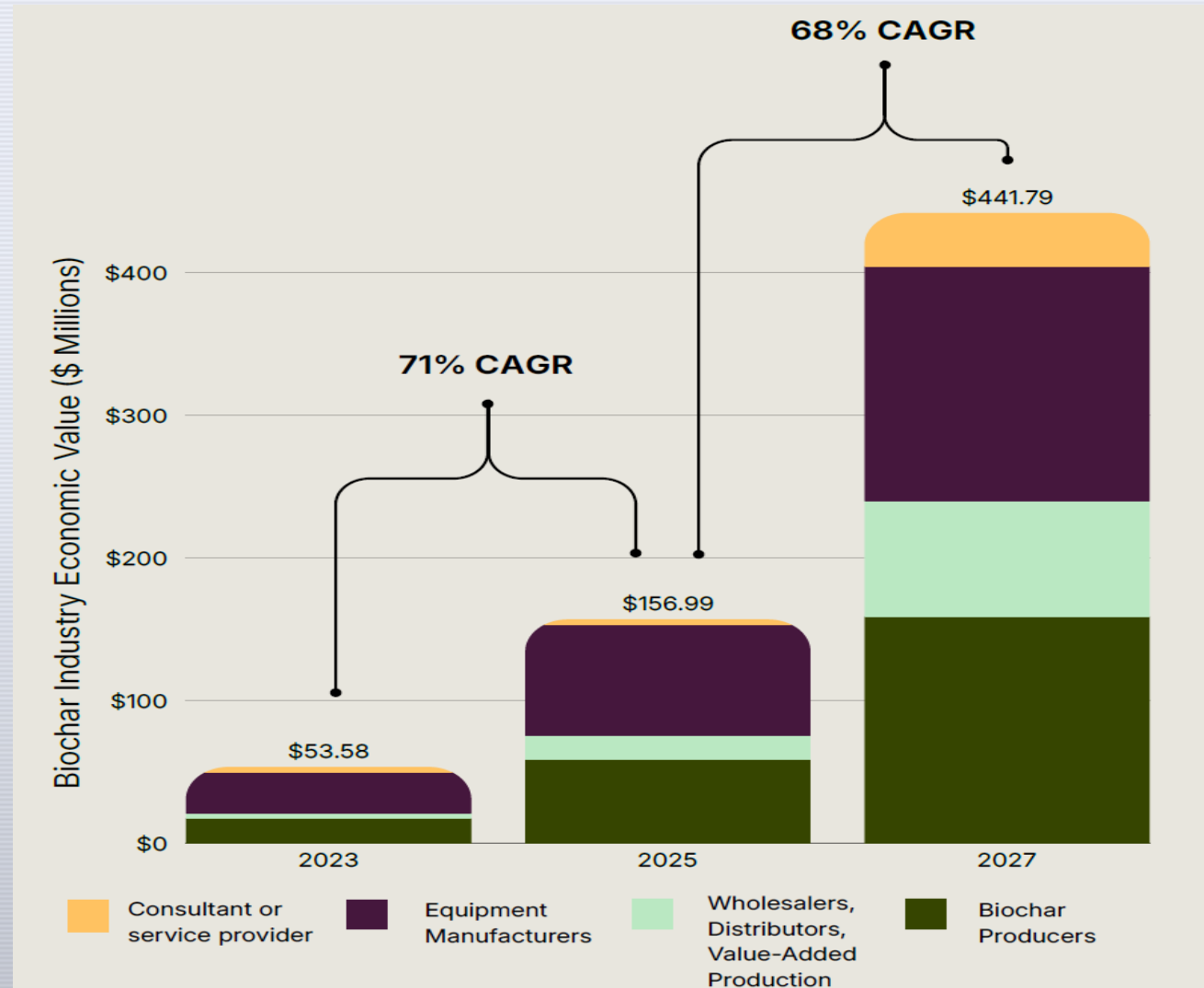


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# BIOCHAR INDUSTRY GROWTH



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