

# Creating a circular economy by converting locally generated waste into biogas, hydrogen, and biocarbon

Presented to:

Los Angeles County  
Department of Public Works  
Alternative Technology  
Advisory Subcommittee

January 19, 2023



**Problem:** Traditional waste management practices emit greenhouse gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O

Landfilling



Land Application



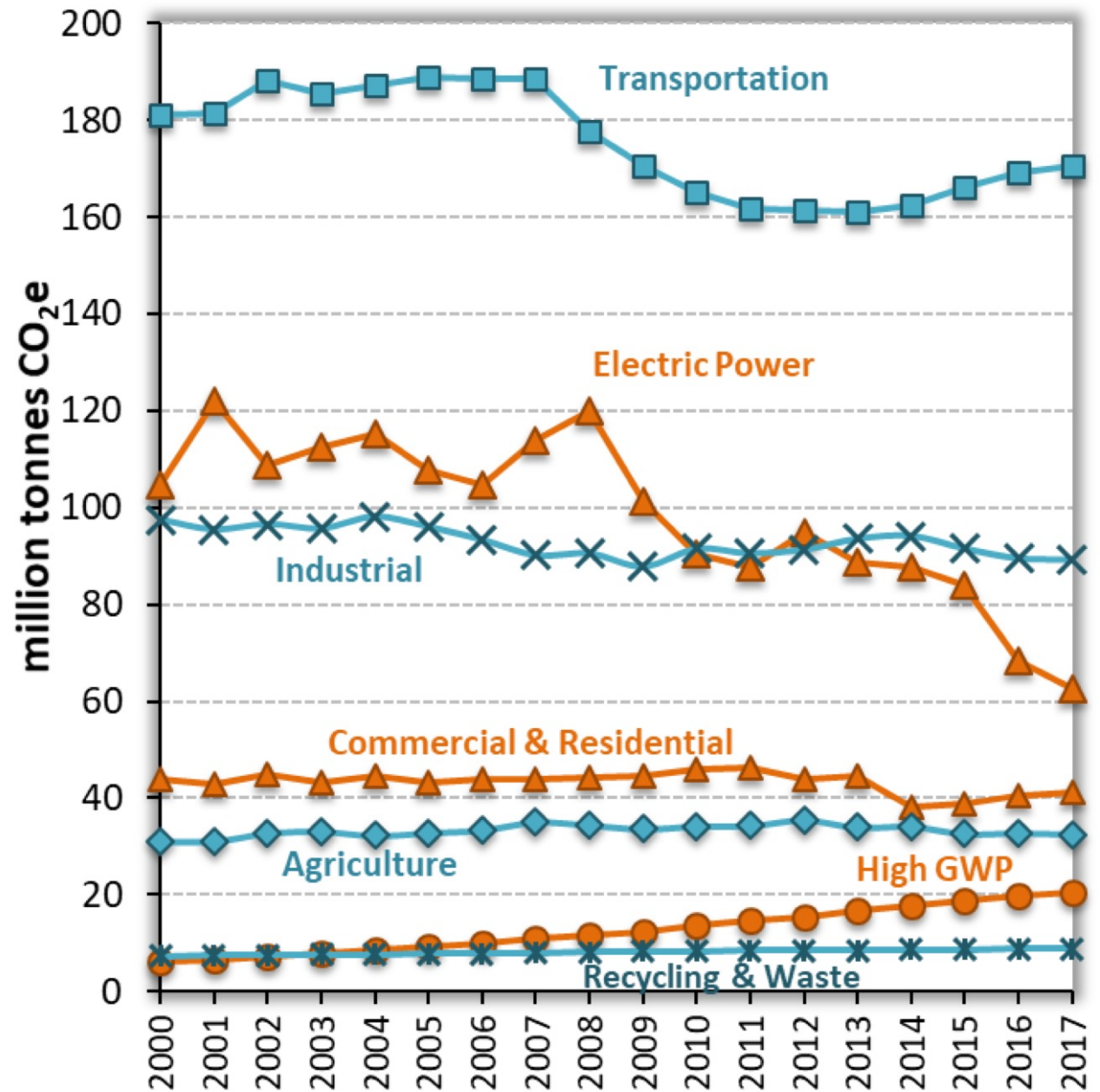
Composting



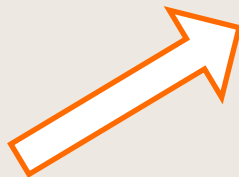
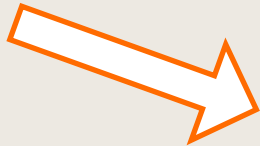
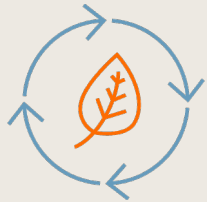
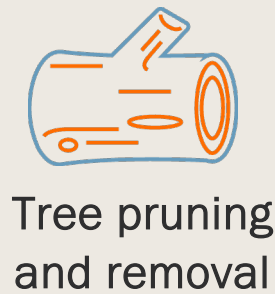
Incineration



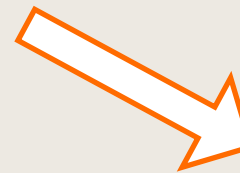
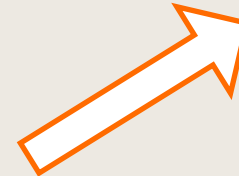
**Problem:**  
Transportation  
accounts for 40%  
of California's  
GHG emissions



**Solution:** Convert "wastes" into low carbon transportation fuel

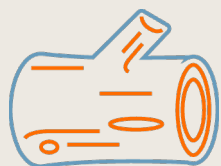


**Kore**

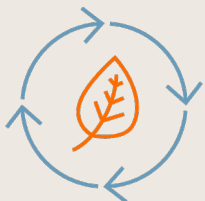


# Existing legislation provides a push and pull for this approach

**P  
U  
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H**



Tree pruning and removal



Biosolids



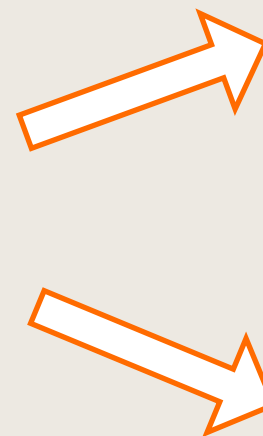
Nut shells



Green waste



**Kore**



**P  
U  
L  
L**



Renewable Hydrogen



Lower Carbon Intensity Fuels

**LCFS & IRA Credits**

**SB 1383**

California generates over **100,000 tons/day** of “waste” feedstock that can be converted into energy

Feedstock	Amount Technically Available per Year
Animal Manure	3.4 million BDT
Fats, Oils, and Greases	207,000 tons
Municipal Solid Waste (food, leaves, grass)	1.2 million BDT
Municipal Solid Waste (lignocellulosic fraction)	6.7 million BDT
Agricultural Residue (lignocellulosic fraction)	5.3 million BDT
Forest, Sawmill, Shrub & Chaparral Residues	26.2 million BDT
Total	42.8 million BDT

*Utilizing forest biomass is important to reduce **wildfire risk***

Sources: Rob Williams and Stephen Kaffka, UC Davis, presentation to the California Energy Commission on January 30, 2017; Lawrence Livermore National Lab assessment of forest, sawmill, shrub & chaparral residues

## Kore was selected for the Department of Conservation “Forest Biomass to Carbon Negative Biofuels” project



### Project Requirements

1. Located in Sierra Nevada
2. Use 60% Forest Biomass
3. Produce H2 or liquid biofuel
4. Carbon negative

### Participating Agencies



CALIFORNIA  
NATURAL  
RESOURCES  
AGENCY



CALIFORNIA  
AIR RESOURCES BOARD

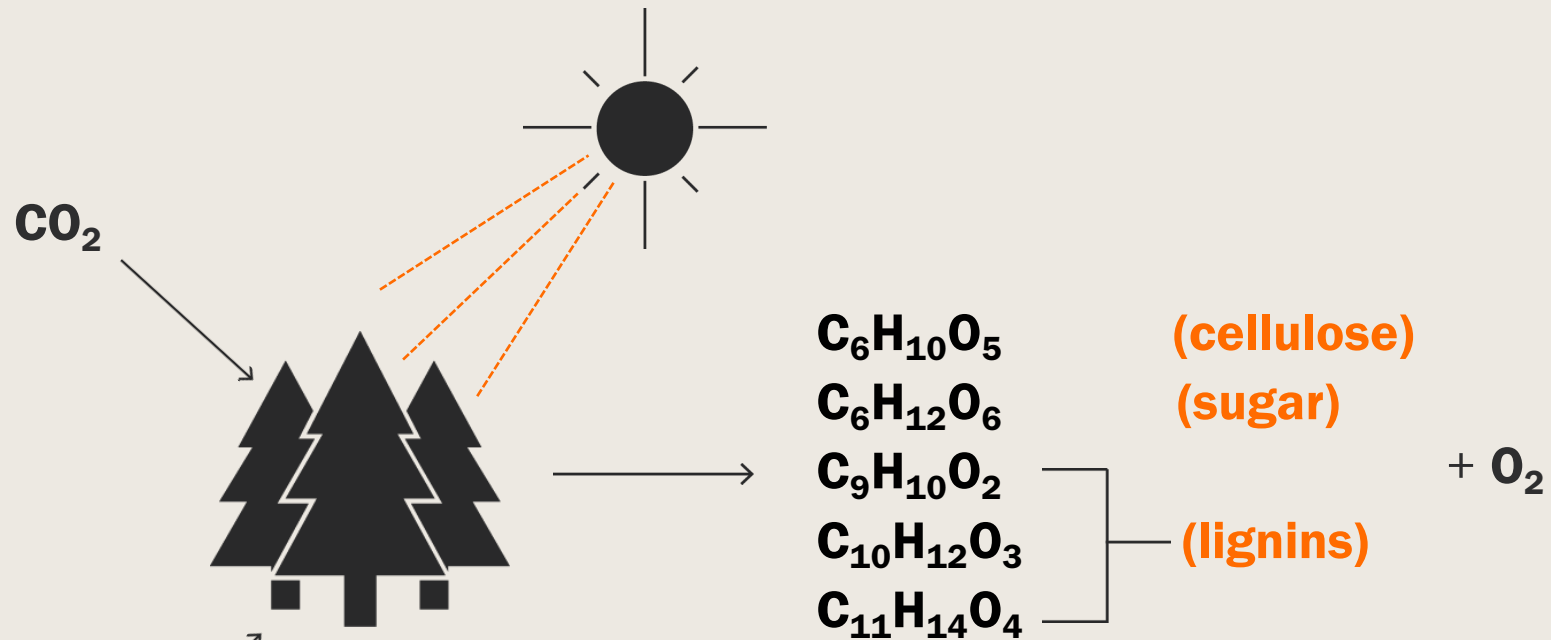


California Infrastructure and  
Economic Development Bank



SIERRA NEVADA  
CONSERVANCY

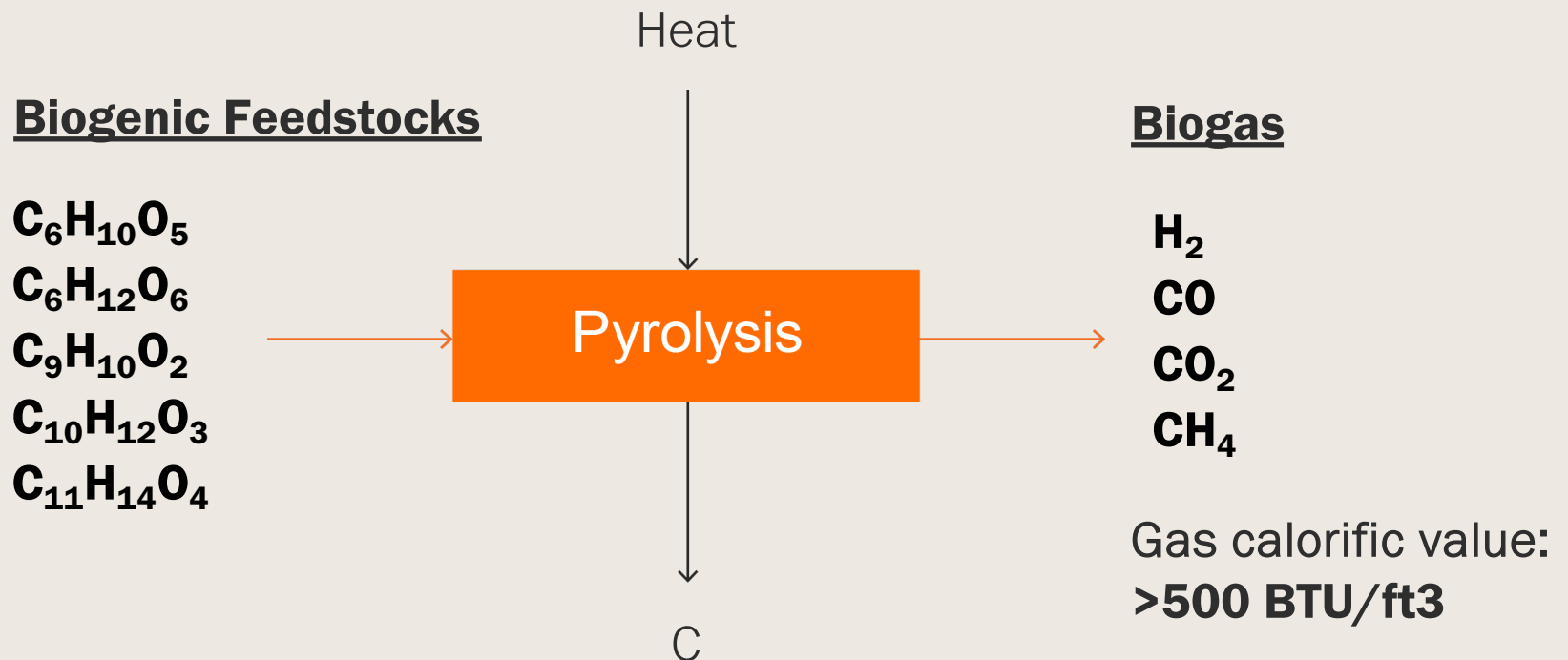
**Biogenic feed** originates with the photosynthetic combination of atmospheric **CO<sub>2</sub>** with **H<sub>2</sub>O** to form a carbohydrate and oxygen



*The chemical composition of wood is approximately 50% carbon, 42% oxygen and 6% hydrogen*

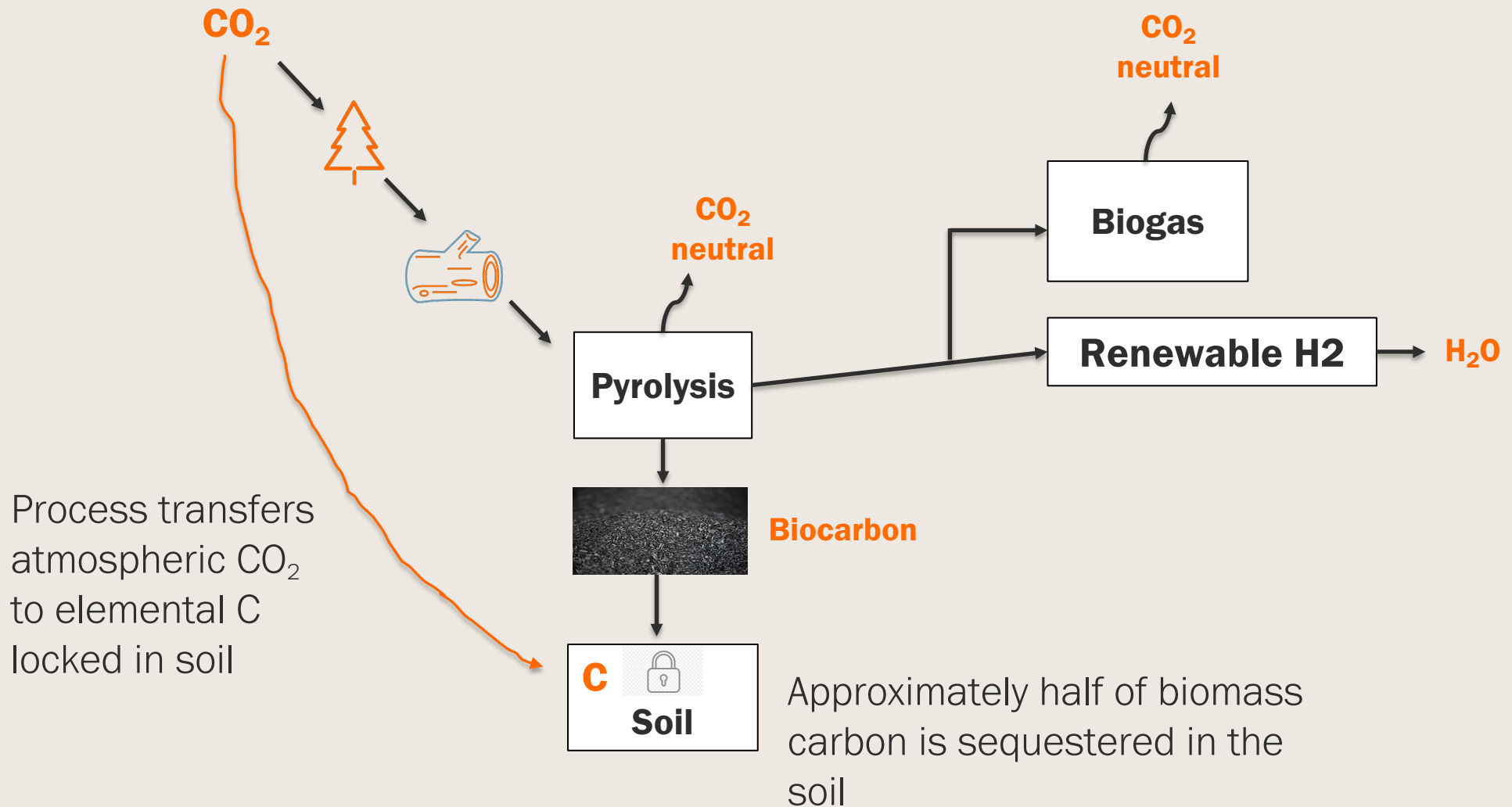


**High-temperature “slow” pyrolysis** converts biogenic feed to gasses and carbon



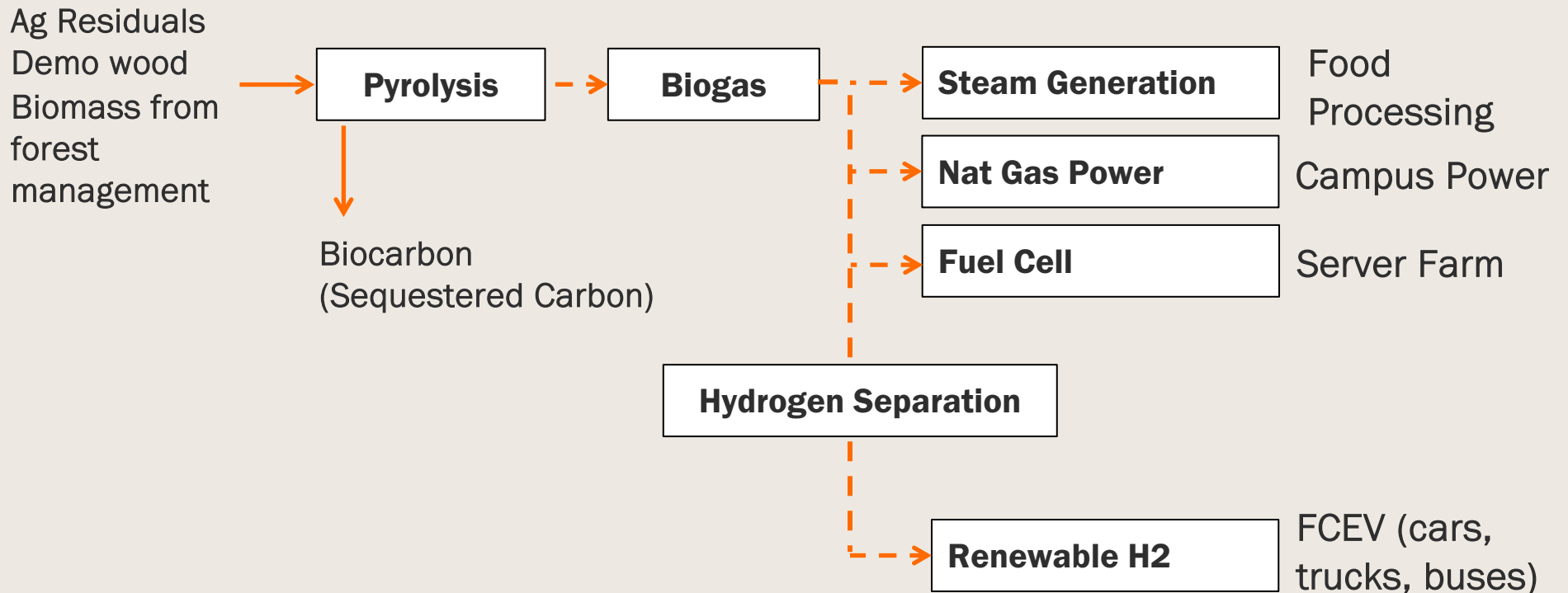
*The gas composition and biocarbon (C) properties depend upon feedstock composition, pyrolysis temperature, and gas and solid retention time*

Pyrolysis leverages the ecosystem services of plants to **reduce atmospheric carbon** (carbon negative process)



## Kore biogas is versatile – it can be used in many carbon negative ways

### Biogenic feedstock



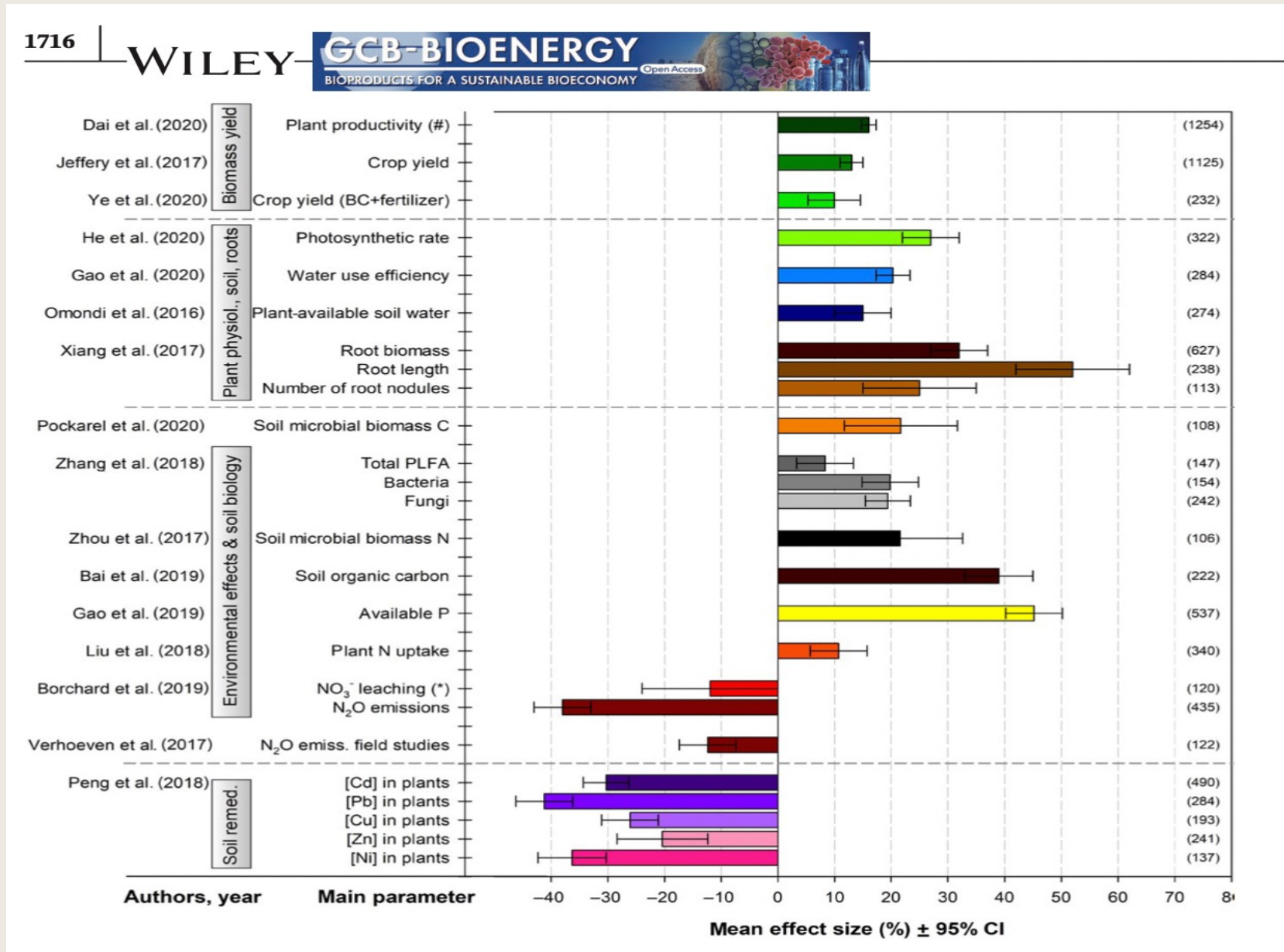
## Biocarbon is the key to carbon management



Figure 1: Biocarbon produced from organic matter. Source: Hans Erken, Flickr.

- Soil Amendment
- Fossil coal substitute for difficult to decarbonize industries
- Carbon negative attributes can be sold as voluntary CO<sub>2</sub> offsets

# Meta-analysis of 26 studies demonstrates that **biocarbon improves every agronomic metric**



## Biocarbon can substitute for fossil coal in difficult to decarbonize industries



California cement manufacturers use **900,000 tons of coal and petroleum coke**, which can be replaced with **carbon neutral “biocarbon”**.  
SB 596 – Low Carbon Cement Standards

The technology described has been **operating at commercial scale** for over a year in southern California.



**Kore Facility**

Project supported technically and financially by:



A Sempra Energy utility®



South Coast  
**AQMD**

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