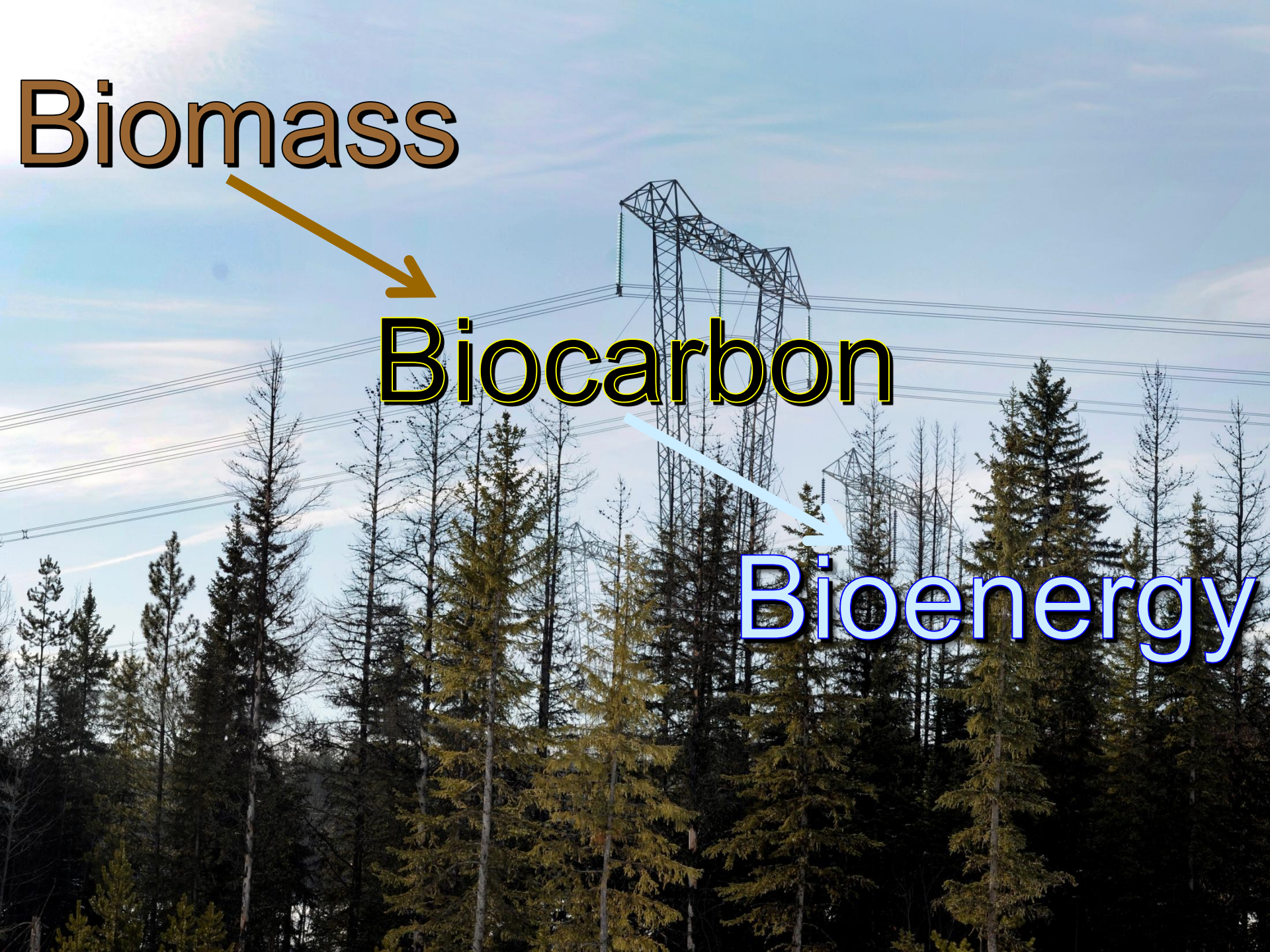

Biomass
Biocarbon
Bioenergy

Solar Carbon Capture

$$CO_2$$

$$+$$

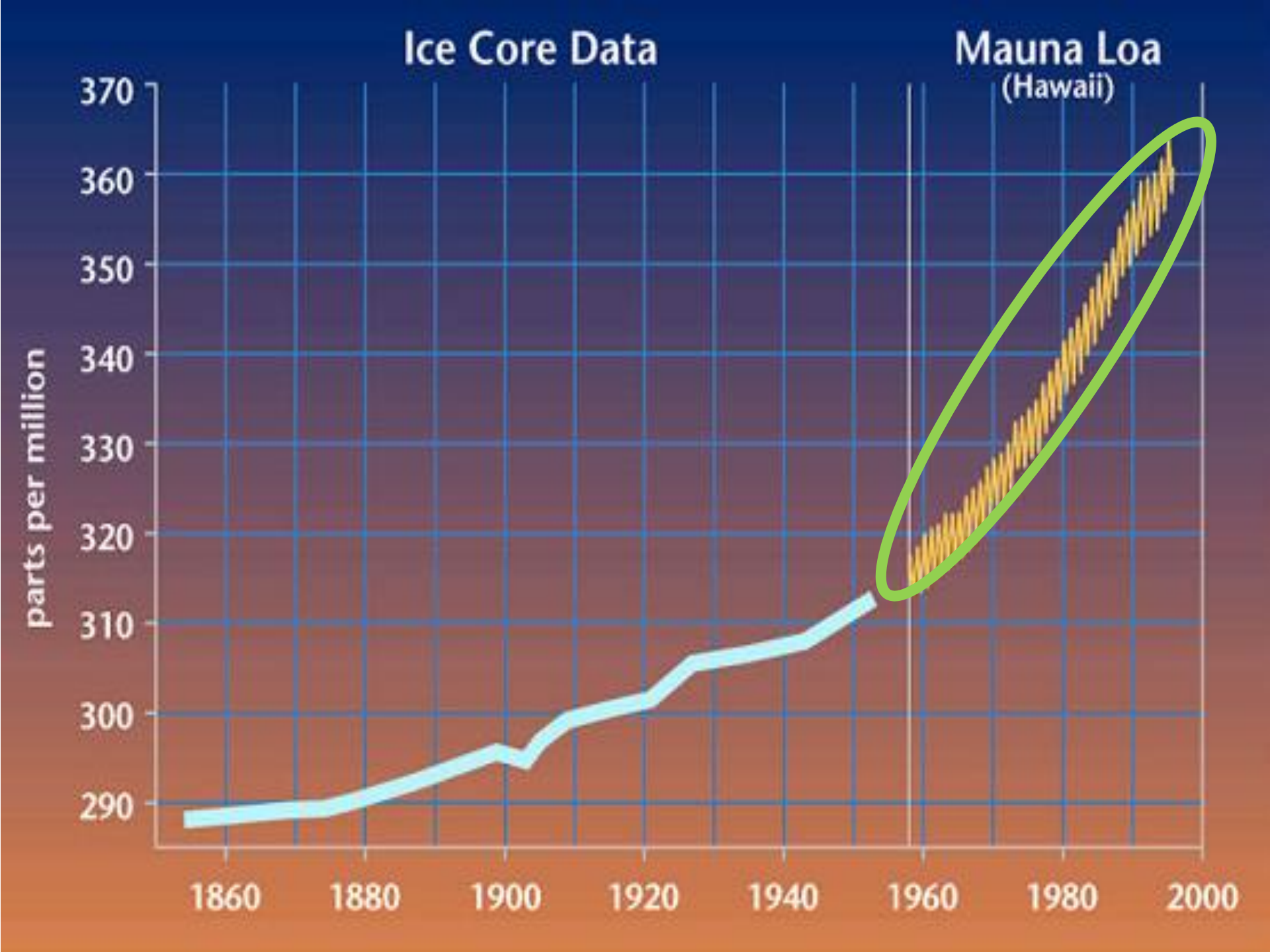
$$H_2O$$

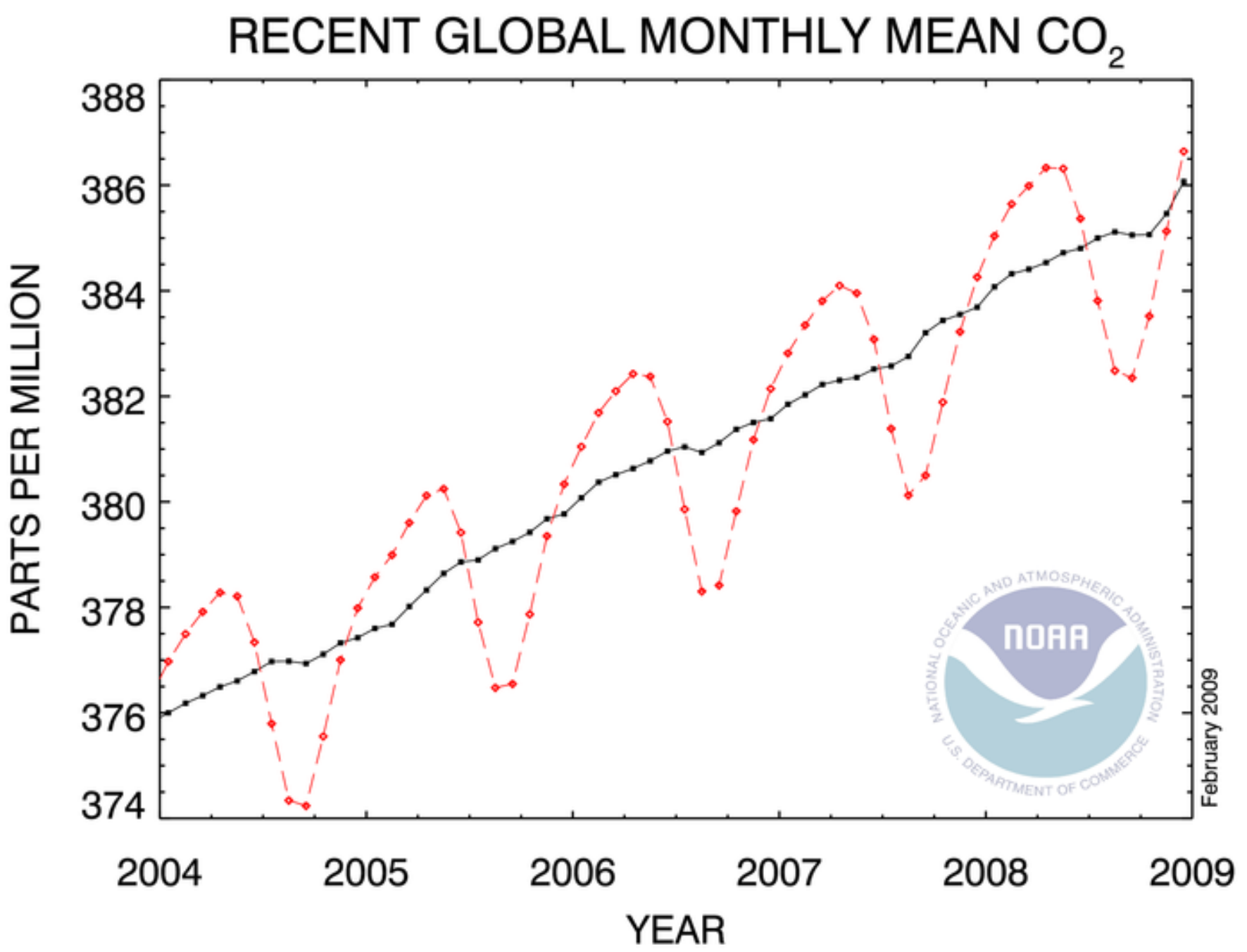
$$\downarrow$$

$$C_6H_{12}O_6$$

"Our **forests** are one of the most important allies we have in the battle against **climate change**."

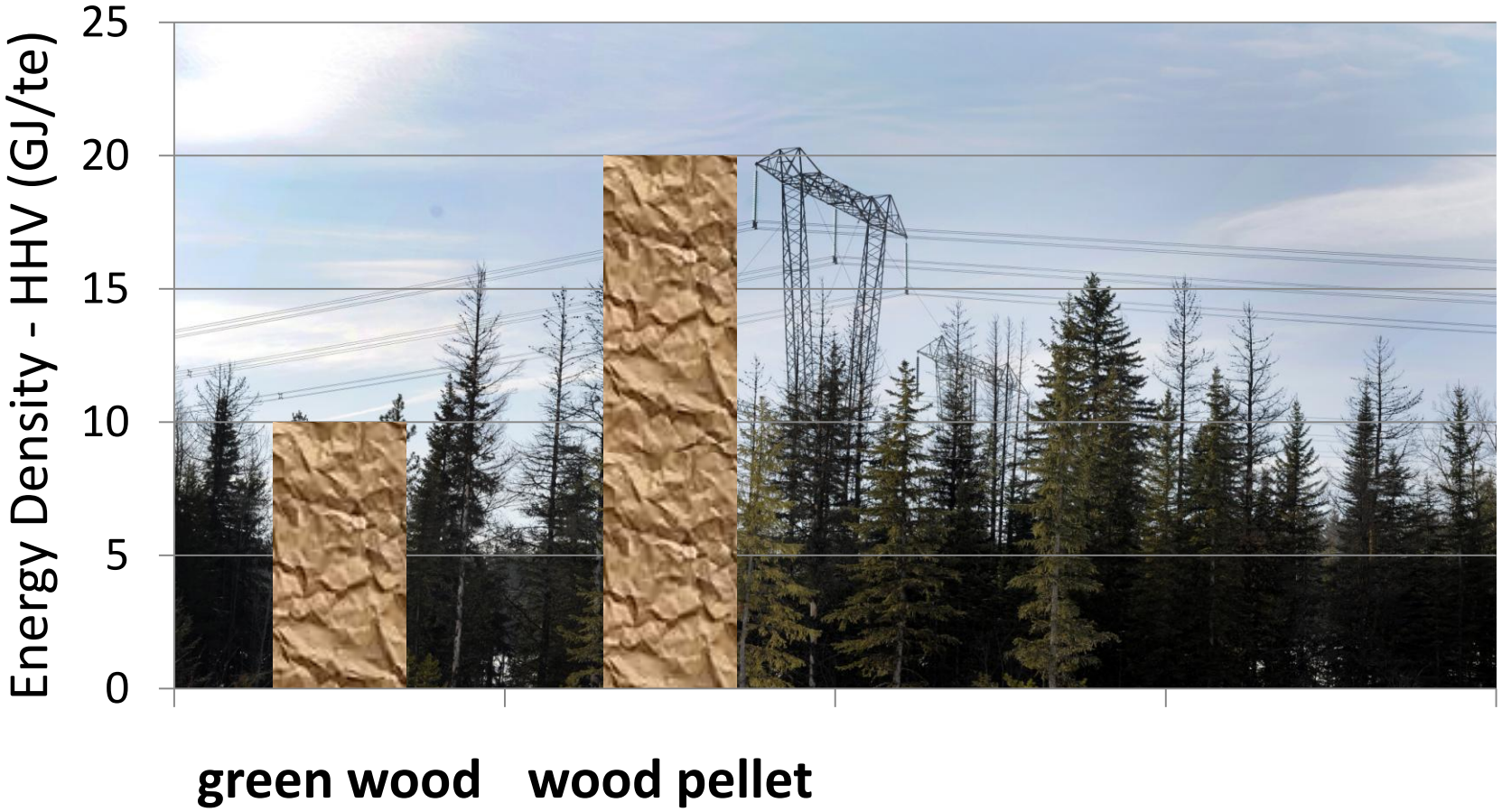
"**Trees** are the only practical way we have to remove CO_2 from the atmosphere."

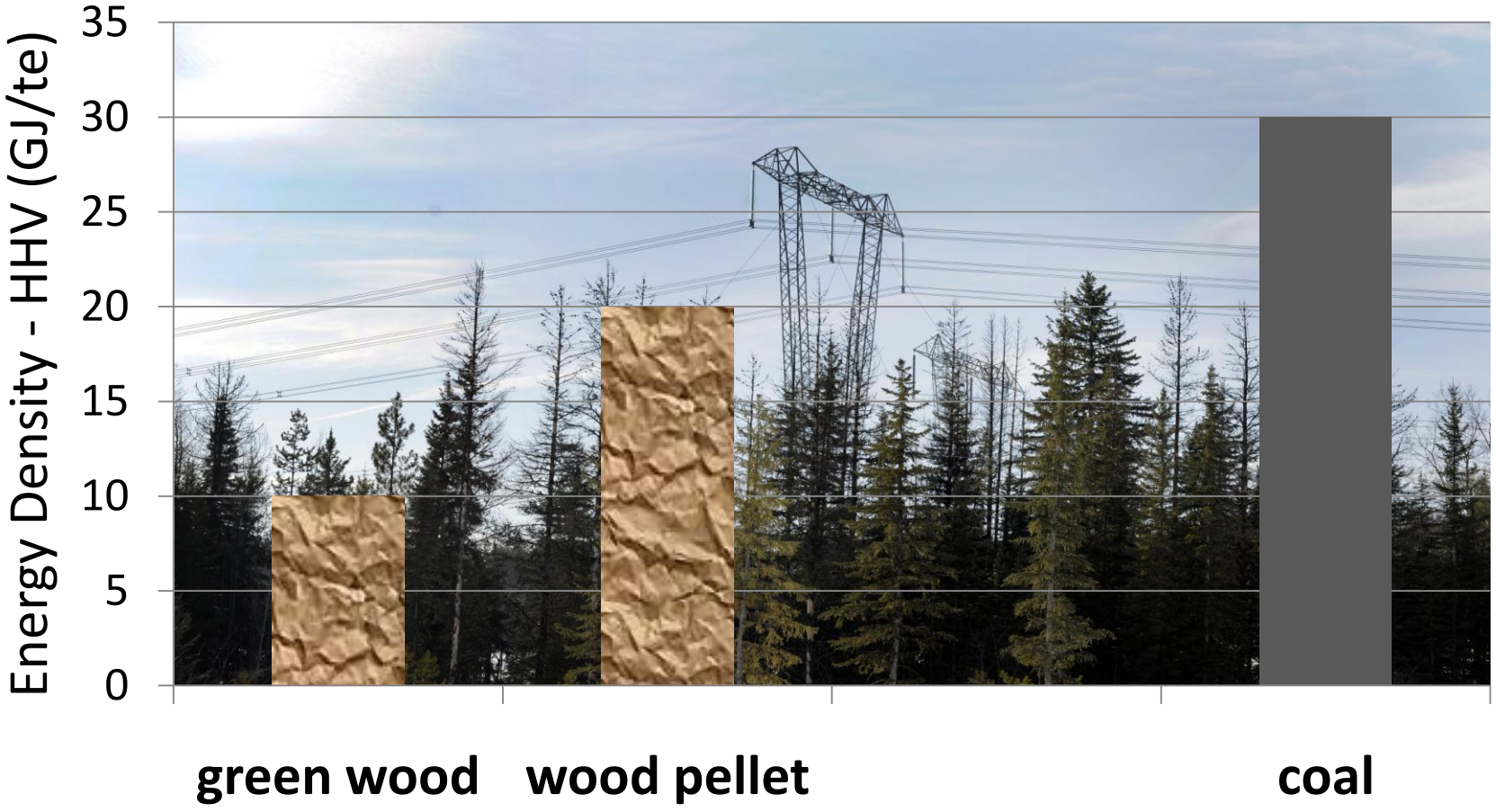

Ice Core Data
Mauna Loa
(Hawaii)
parts per million
370
360
350
340
330
320
310
300
290
1860
1880
1900
1920
1940
1960
1980
2000

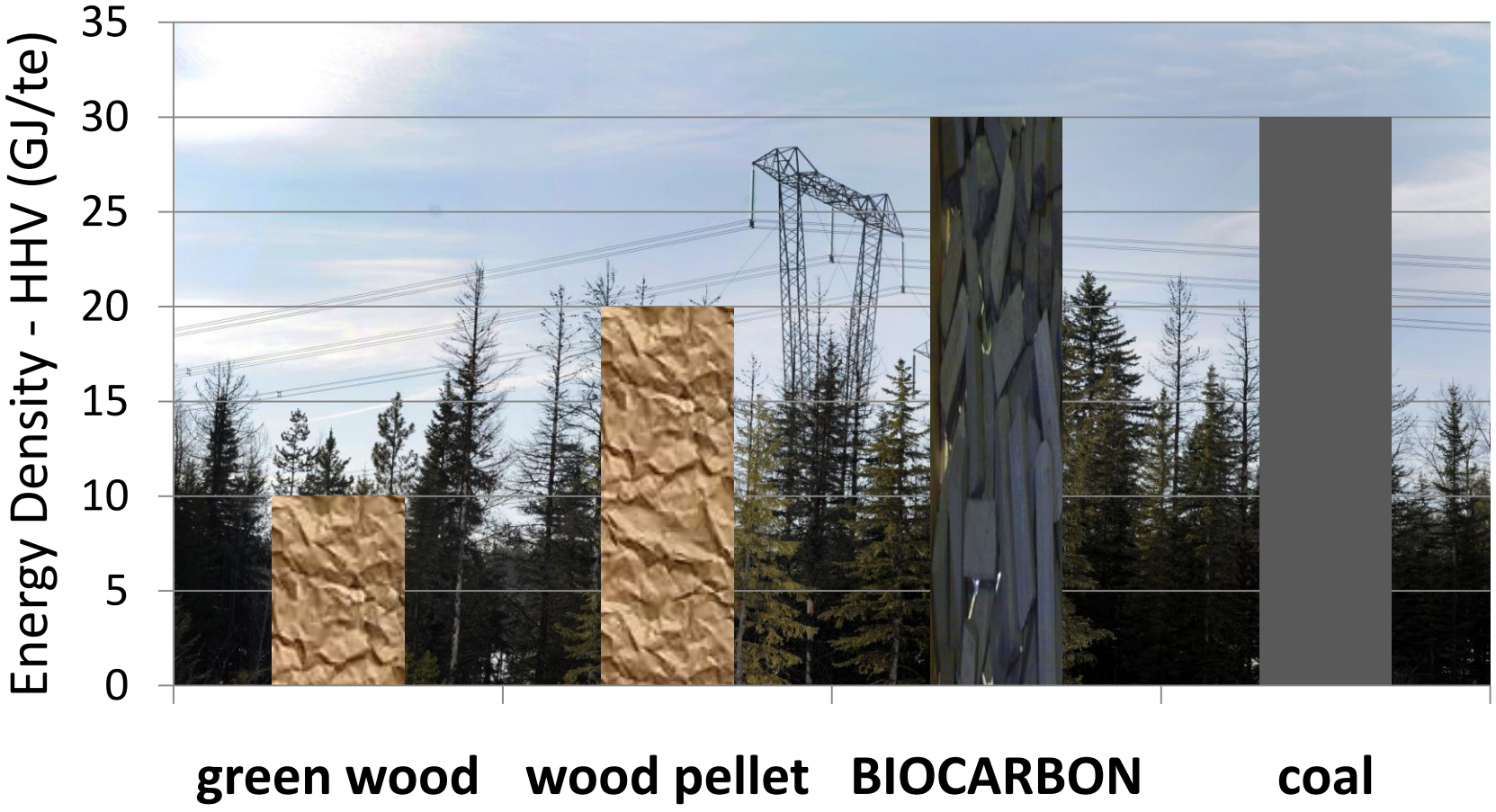

RECENT GLOBAL MONTHLY MEAN CO_2
PARTS PER MILLION
388
386
384
382
380
378
376
374
2004
2005
2006
2007
2008
2009
YEAR
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE
February 2009

BIOCARBON:

The Carbonization of Biomass

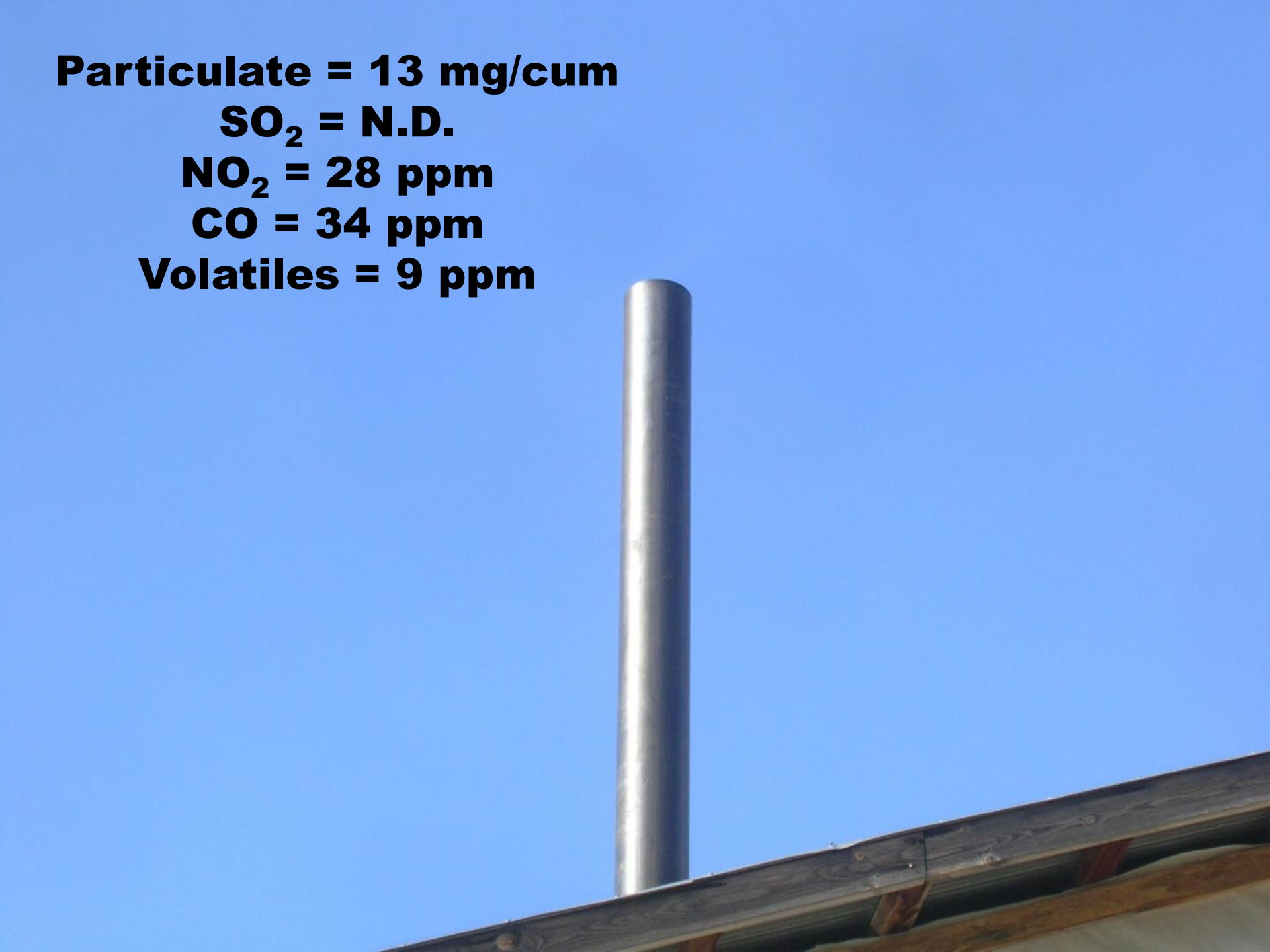

Energy Density - HHV (GJ/te)
25
20
15
10
5
0
green wood
wood pellet

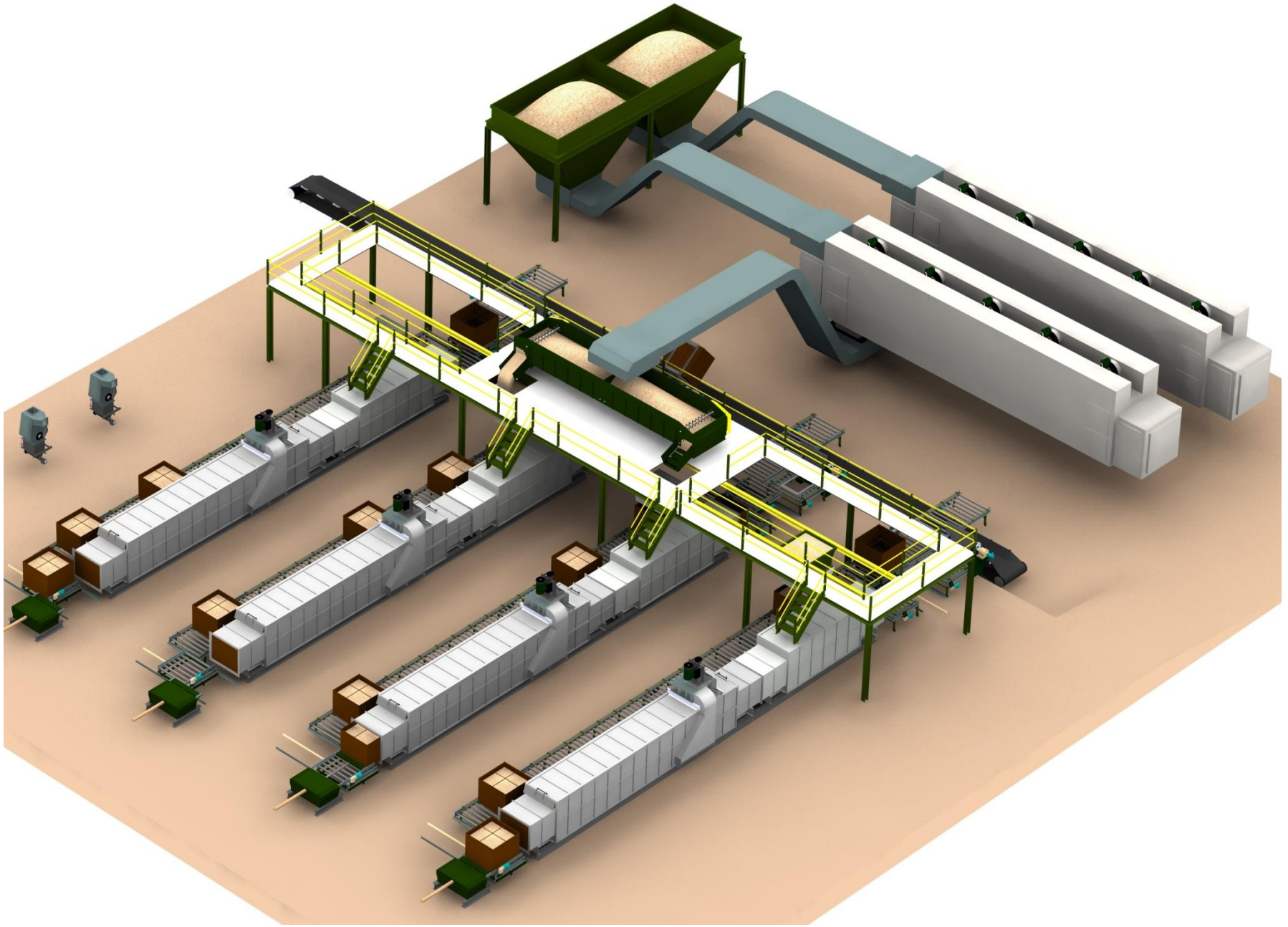

Energy Density - HHV (GJ/te)
35
30
25
20
15
10
5
0
green wood
wood pellet
coal

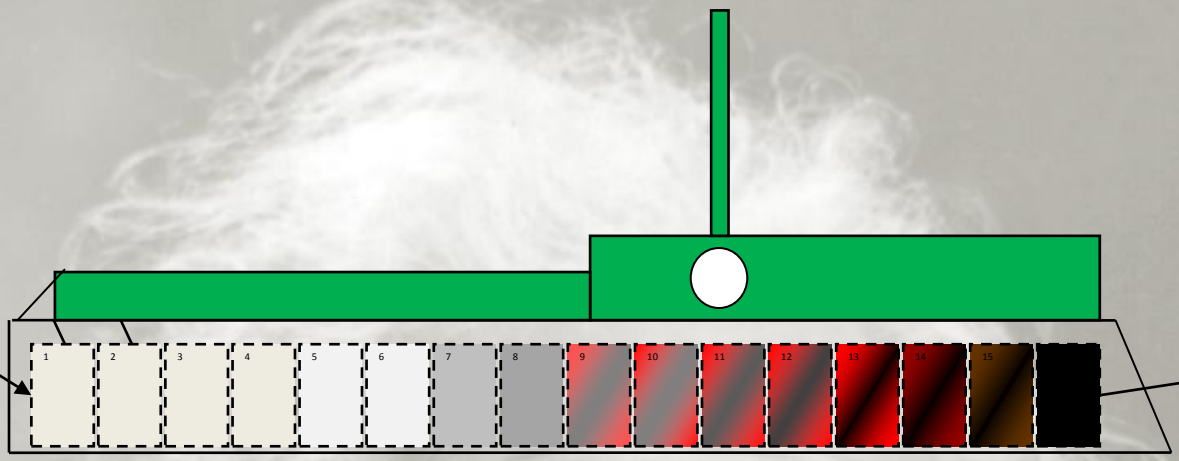

Energy Density - HHV (GJ/te)
35
30
25
20
15
10
5
0
green wood
wood pellet
BIOCARBON
coal

alterna energy inc

Biocarbon Technical Facility
McBride


Particulate = 13 mg/cum
SO_2 = N.D.
NO_2 = 28 ppm
CO = 34 ppm
Volatiles = 9 ppm





BIOMASS

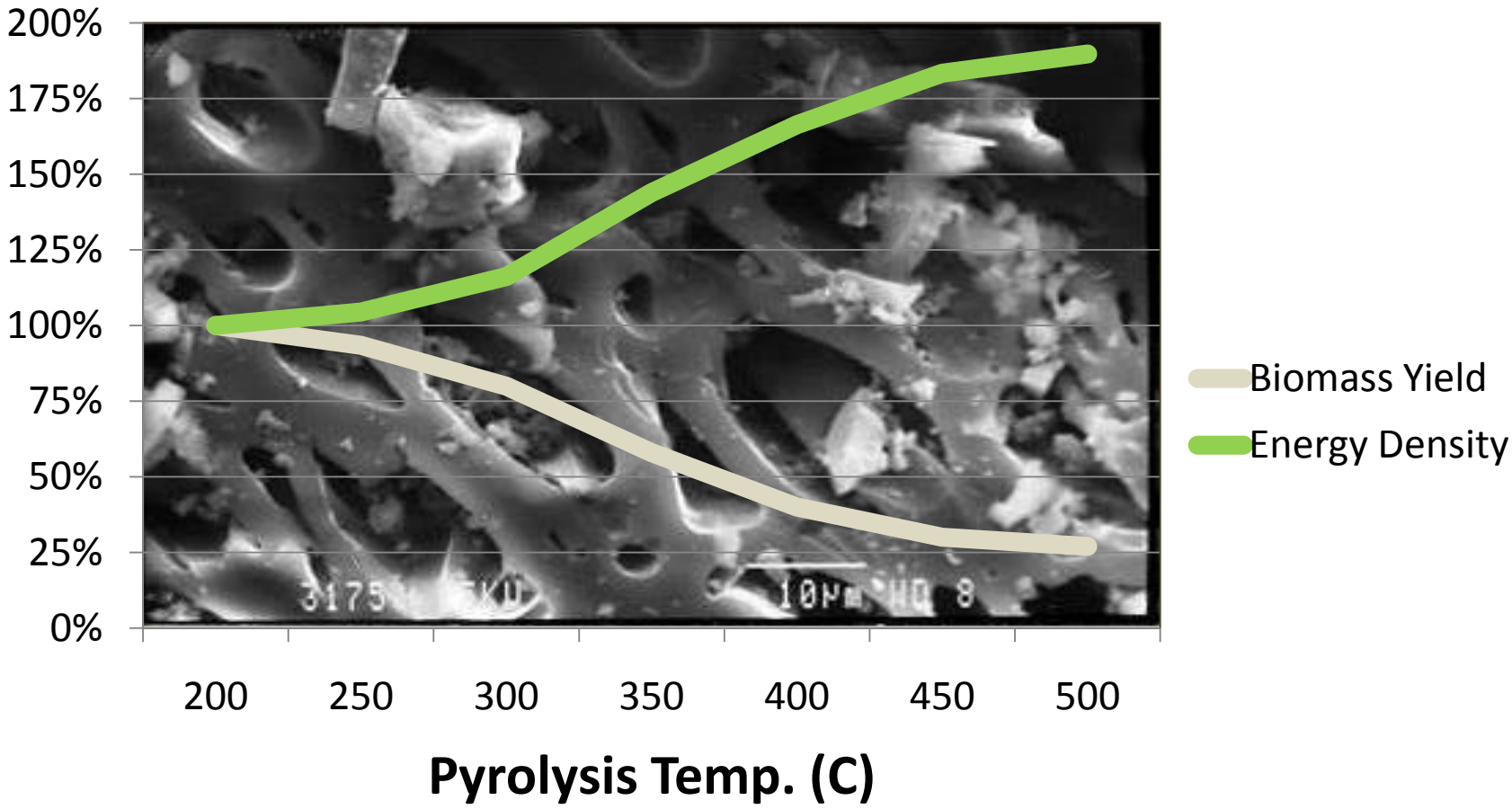
DRYING

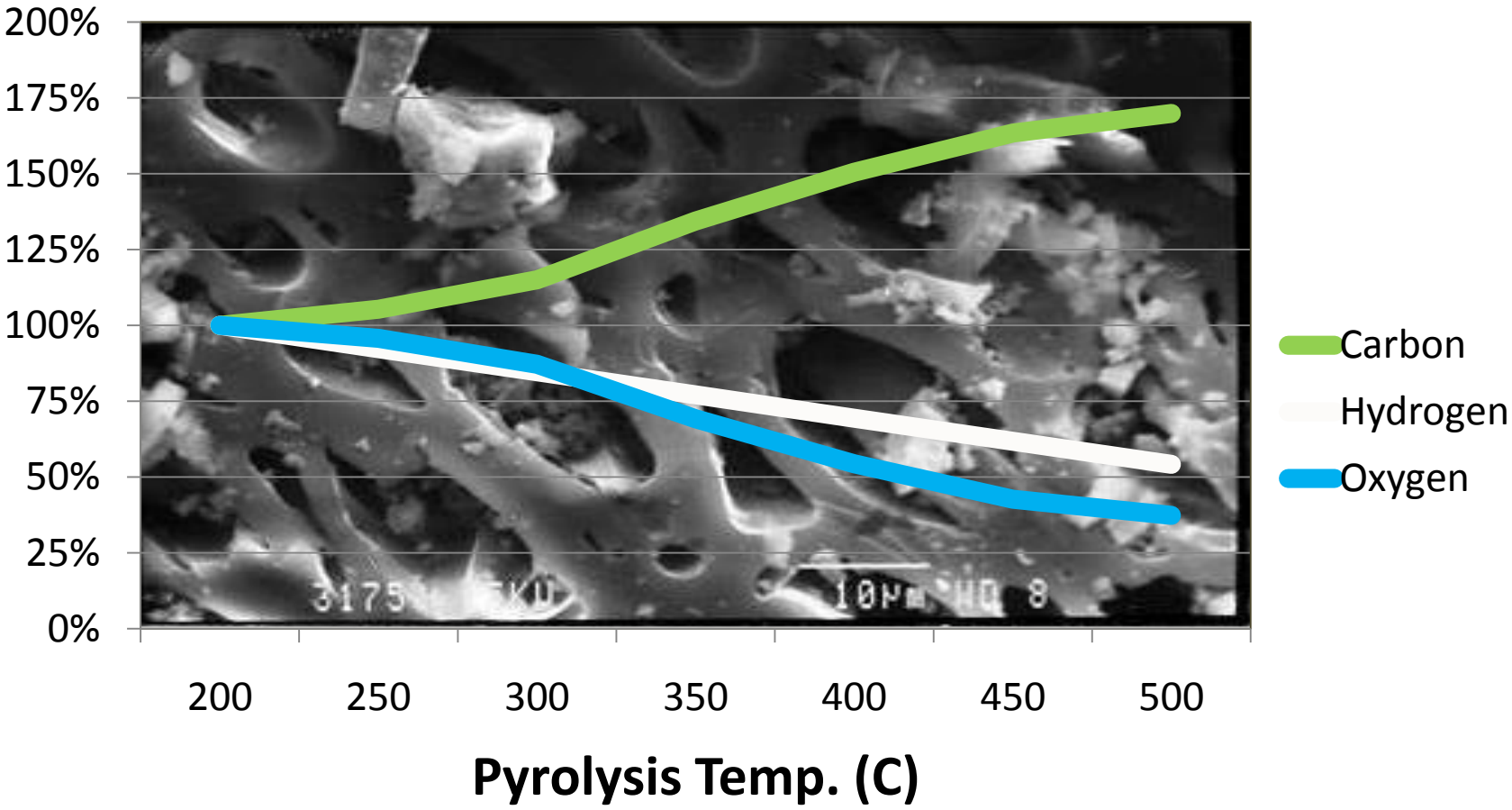
Pyrolysis
Dehydration
Decarbonylation

Carbonization
Depolymerization
Radical formation

COOLING

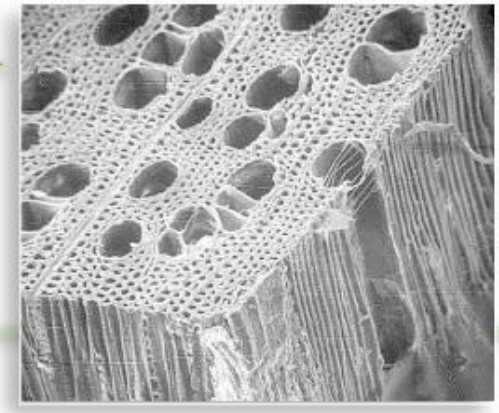
BIOCARBON

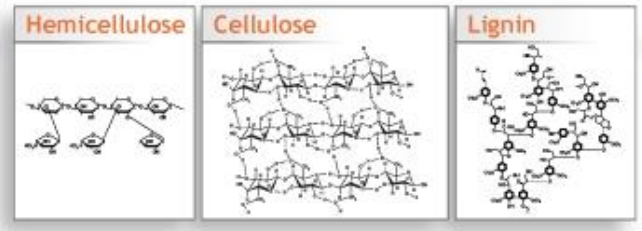

200%
175%
150%
125%
100%
75%
50%
25%
0%
200
250
300
350
400
450
500
Pyrolysis Temp. (C)
Biomass Yield
Energy Density

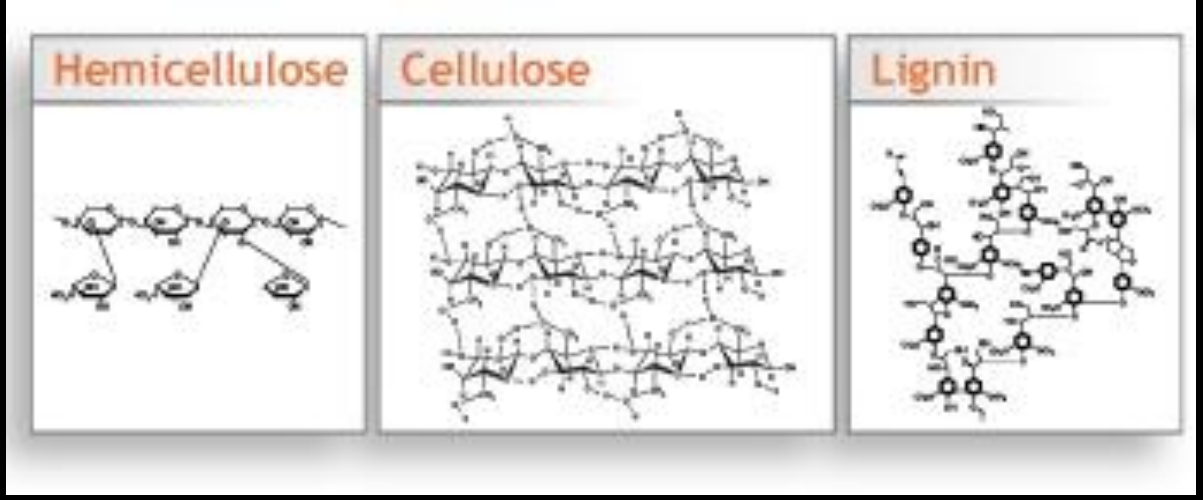

200%
175%
150%
125%
100%
75%
50%
25%
0%
200
250
300
350
400
450
500
Pyrolysis Temp. (C)
Carbon
Hydrogen
Oxygen

Yields

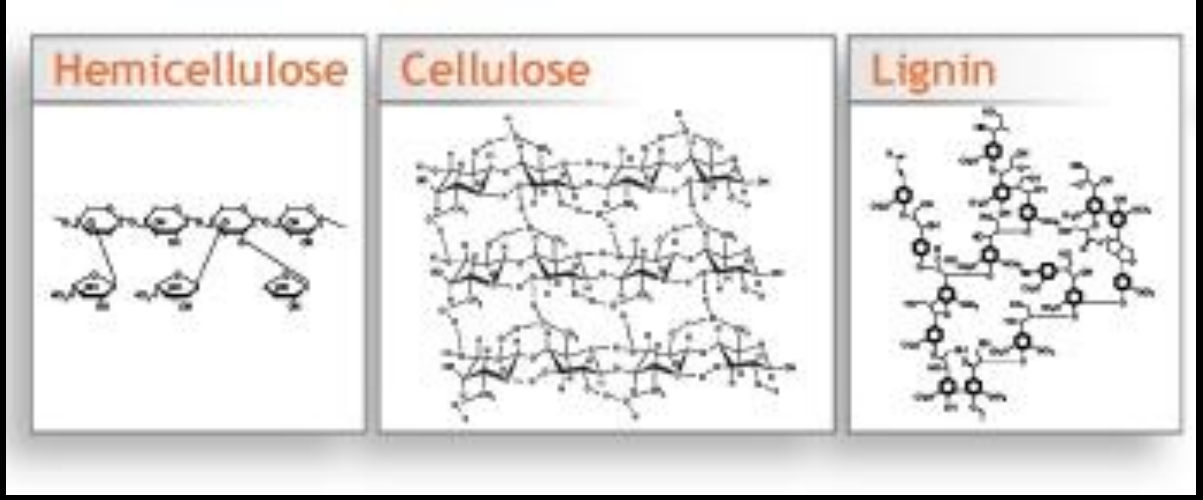
Basis	Low	High
Mass	35%	45%
Carbon (52%/81%)	55%	70%
Energy (20/30 GJ/te)	53%	68%



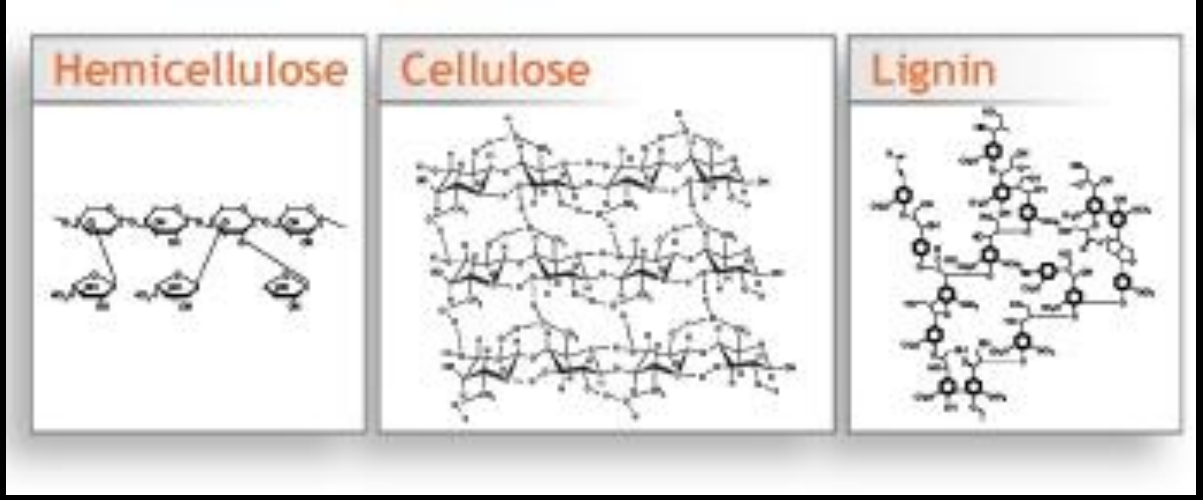

Hemicellulose
Cellulose
Lignin



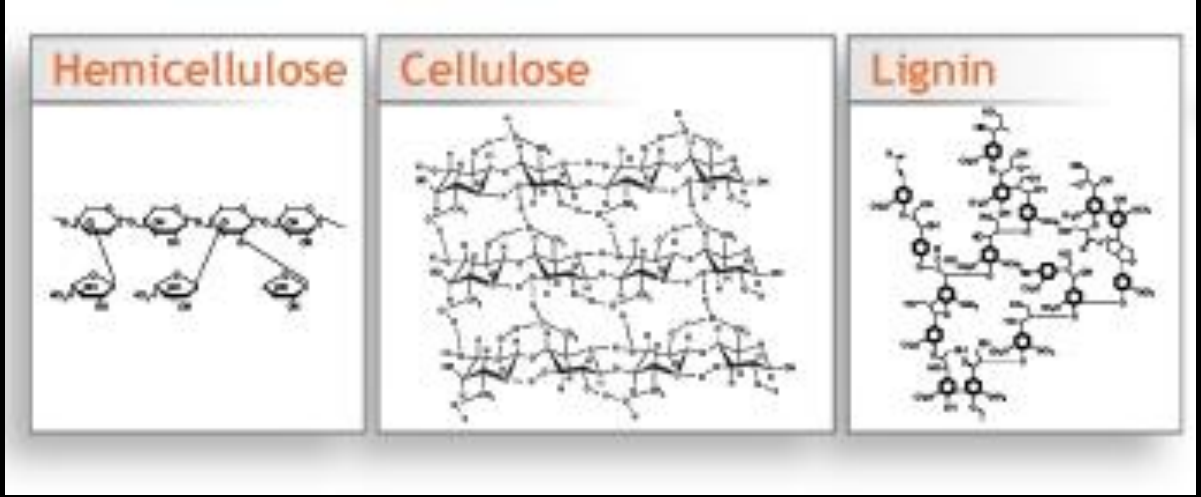
- 120 C to 200 C
  - dehydration



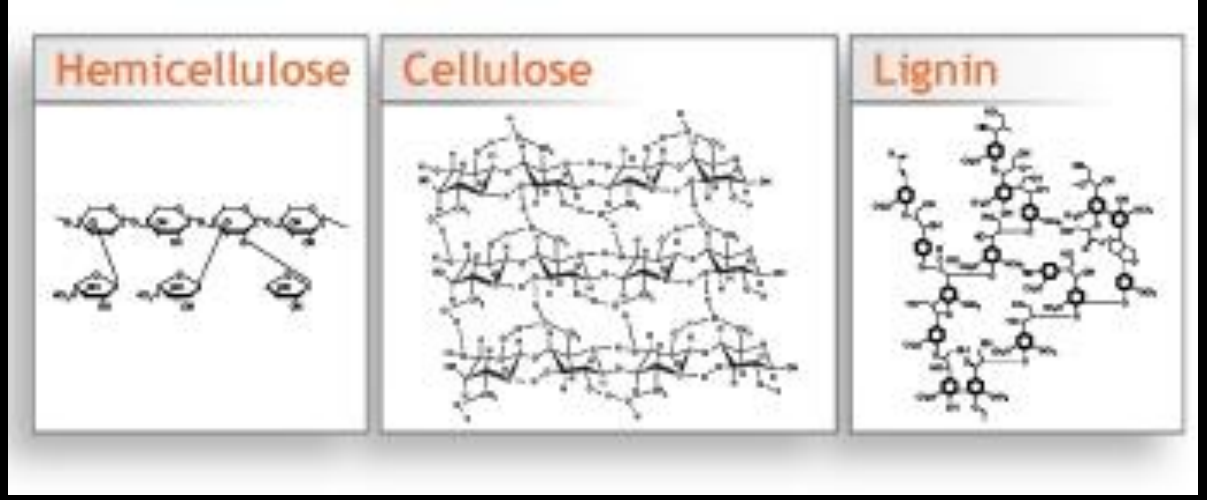
- 220 C to 260 C
  - Hemicellulose degradation
    - Water
    - Hydrogen
    - Carbon dioxide
    - Carbon monoxide
    - Methane
    - Acetic acid
    - Methanol
    - Furfural



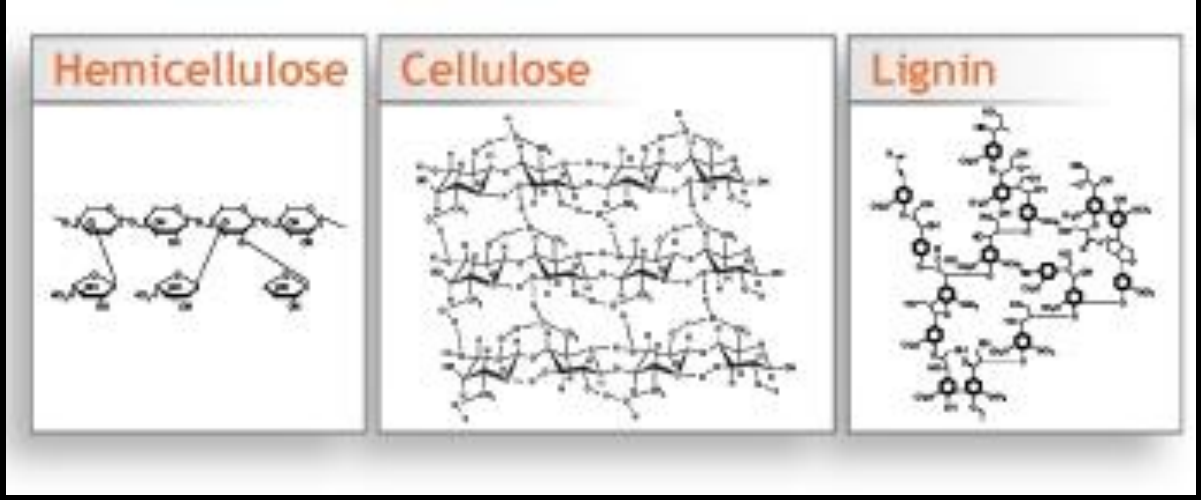
- 200 C to 300 C
  - Torrefaction zone



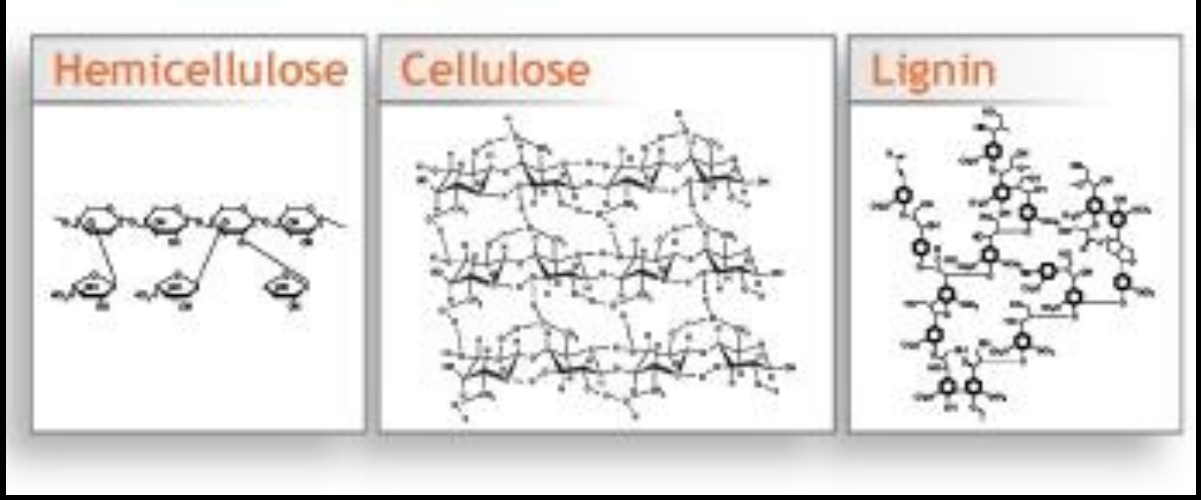
- 250 C to 350 C
  - Cellulose degradation
    - Carbon dioxide
    - Biocarbon
    - Tarry vapours



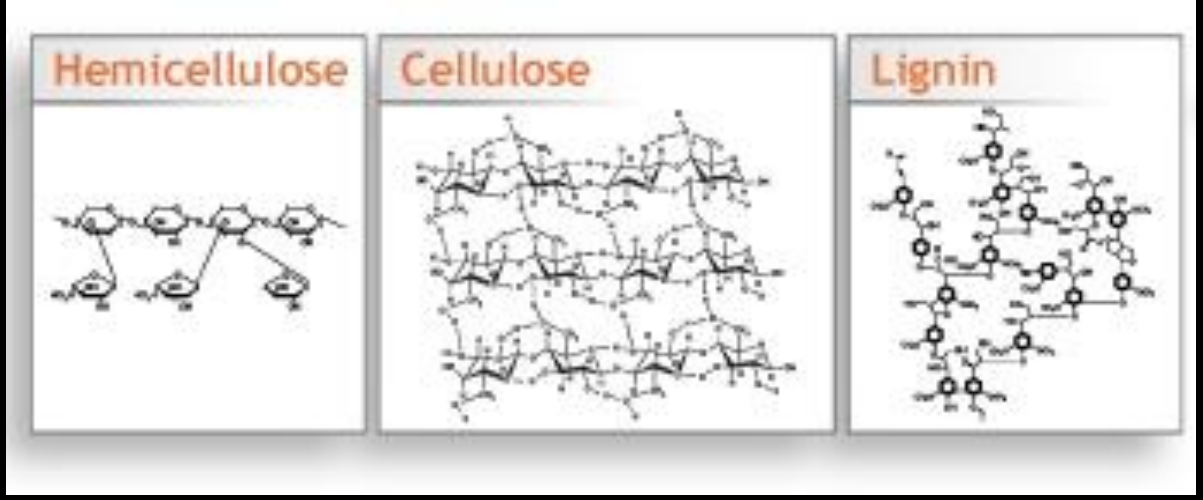
- >280 C
  - Lignin degradation
    - Carbon monoxide
    - Methane
    - Ethane
    - Methanol
    - Acetic Acid
    - Acetone
    - Wood tars
    - Biocarbon



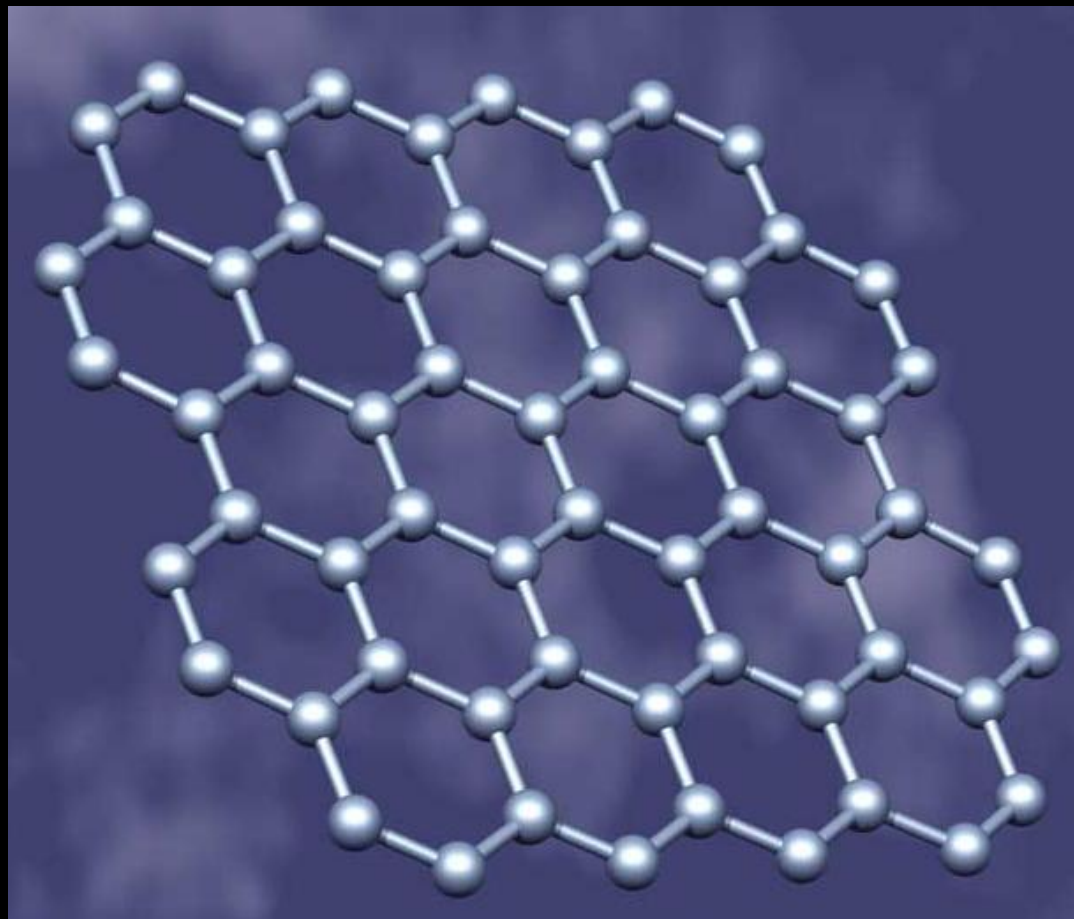
- >330 C
  - Aromaticity rises
  - Carbon content rises
  - Graphene sheets appear



- >600 C
  - Gasification
  - Activation

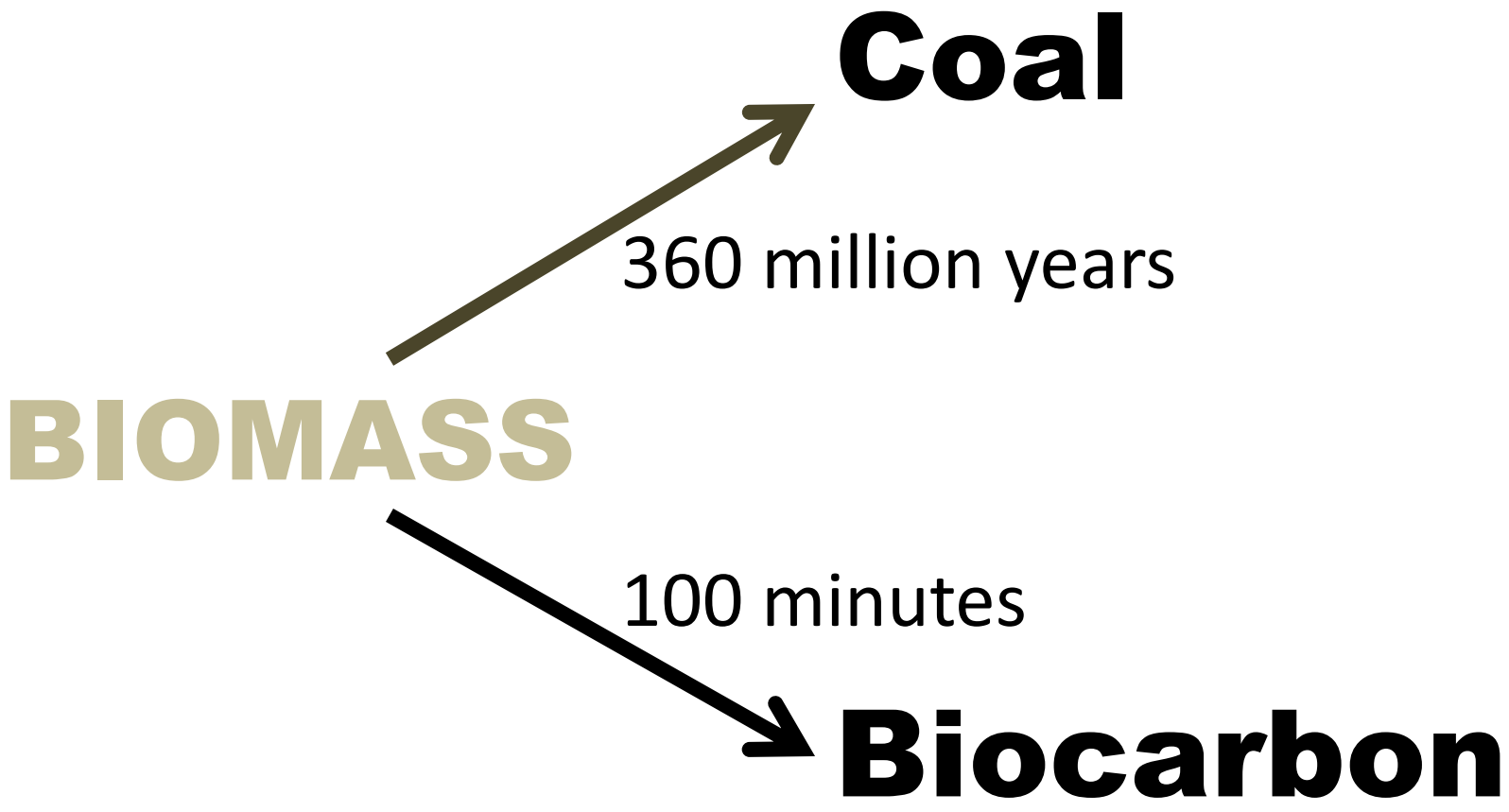


- 2000 C to 3500 C
  - Graphite formation



BIOCARBON:

The Renewable Option for Coal


Coal
360 million years
BIOMASS
100 minutes
Biocarbon

Coal

- Biomass
  - Carboniferous
  - 360 MM years
  - Fossil fuel

Biocarbon

- Biomass
  - Carbonization
  - 100 minutes
  - Renewable fuel

Coal

- Biomass
- Carboniferous
- 360 MM years
- Fossil fuel

Biocarbon

- Biomass
- Carbonization
- 100 minutes
- Renewable fuel

Coal

- Biomass
- Carboniferous
- 360 MM years
- Fossil fuel

Biocarbon

- Biomass
- Carbonization
- 100 minutes
- **Renewable fuel**

Coal

- 60% to 90% carbon
- 10% to 40% VM

Biocarbon

- 70% to 90% carbon
- 10% to 40% VM

Coal

- 60% to 90% carbon
- 10% to 40% VM

Biocarbon

- 70% to 90% carbon
- 10% to 40% VM

Typical Analysis

	Powder River Basin	Pittsburgh Seam	Biocarbon
Carbon %	51.2	73.6	84.9
Hydrogen %	3.5	4.7	1.9
Nitrogen %	0.7	1.3	0.4
Sulphur %	0.2	1.6	<0.05
Oxygen %	12.7	4.9	6.7
Ash %	4.5	13.7	6.1
Fixed Carbon %	37.5	55.7	84.9
Volatile Matter %	30.1	30.6	12.9
HHV GJ/te	20.5	30.2	30.2
HHV btu/lb.	8,800	12,400	12,400

Coal

- 7,000 to 12,750 btu/lb

Biocarbon

- 12,500 btu/lb

Coal

- 10% ash
  - 5% SiO_2
  - 1% to 7% S
  - 0.2 ppm Hg
  - 24 ppm As
  - 0.4 ppm Se

Biocarbon

- 7% ash
  - 3% SiO_2
  - <0.05% S
  - 0.003 ppm Hg
  - <0.2 ppm As
  - <0.2 ppm Se

Alterna Biocarbon

alterna energy inc