

# Woody Biomass Overview



# Energy Demand

Worldwide demand for fossil fuels projected to increase dramatically over the next 20 years.



The U.S. has relatively unstable relationships with the countries that have major oil reserves.

# Energy Demand



Fossil fuel-related energy costs continue to rise.

The U.S. uses more fossil fuels than the next 5 highest consuming countries



# Climate Change

- Climate change is occurring
- CO<sub>2</sub> is a major greenhouse gas produced from burning fossil fuels
- Climate change is and will continue to impact the planet's ecosystems in ways we don't fully understand



# Wildfires

Years of fire suppression have left forests throughout the U.S. overstocked and in need of fuel load reduction.

Due to climate change, some places will experience hotter, drier summers which may exacerbate this problem.



# Situation becomes Opportunity

- Increasing population and needs
- Existing forest cover
- Currently fossil fuels are main energy source
- How many strategies can we use to improve the situation?
- Wood is one of many possibilities

# What is Woody Biomass?

Woody biomass is the accumulated mass, above and below ground, of the roots, wood, bark, and leaves of living and dead woody shrubs and trees.



# Potential Sources of Woody Biomass

- Urban and municipal waste wood
  - Yard trimmings
  - Storm damage
  - Construction and demolition waste
- Land-clearing debris





# More Potential Sources of Woody Biomass

## Forestry residues

- Thinning for forest health, wildfire risk reduction
- Branches from harvesting
- Processing residue



Energy plantation fiber

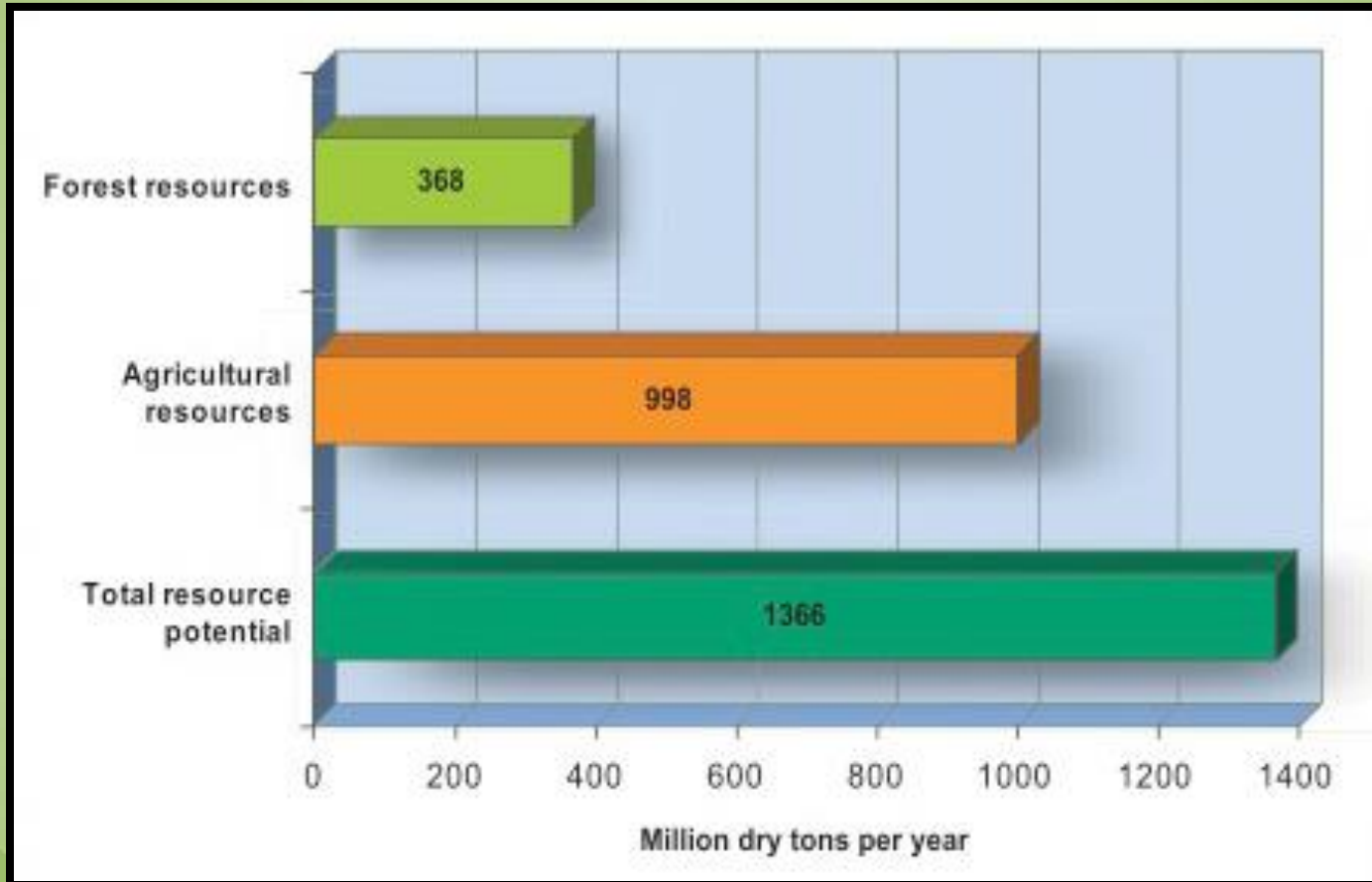
# Other Sources of Biomass

## Agricultural Residues

- Food-based
- Non Food-based
- Perennial Grasses
- Animal Waste



# Biomass Availability in the U.S.



Annual Biomass Resource Potential from Forest and Agricultural Resources - USDA/DOE, 2005

# Potential Benefits of Using Wood

- Additional wood market for landowners interested in sustainable forestry
- Forest management can:
  - reduce wildfire behavior
  - enhance forest health
  - improve wildlife habitat

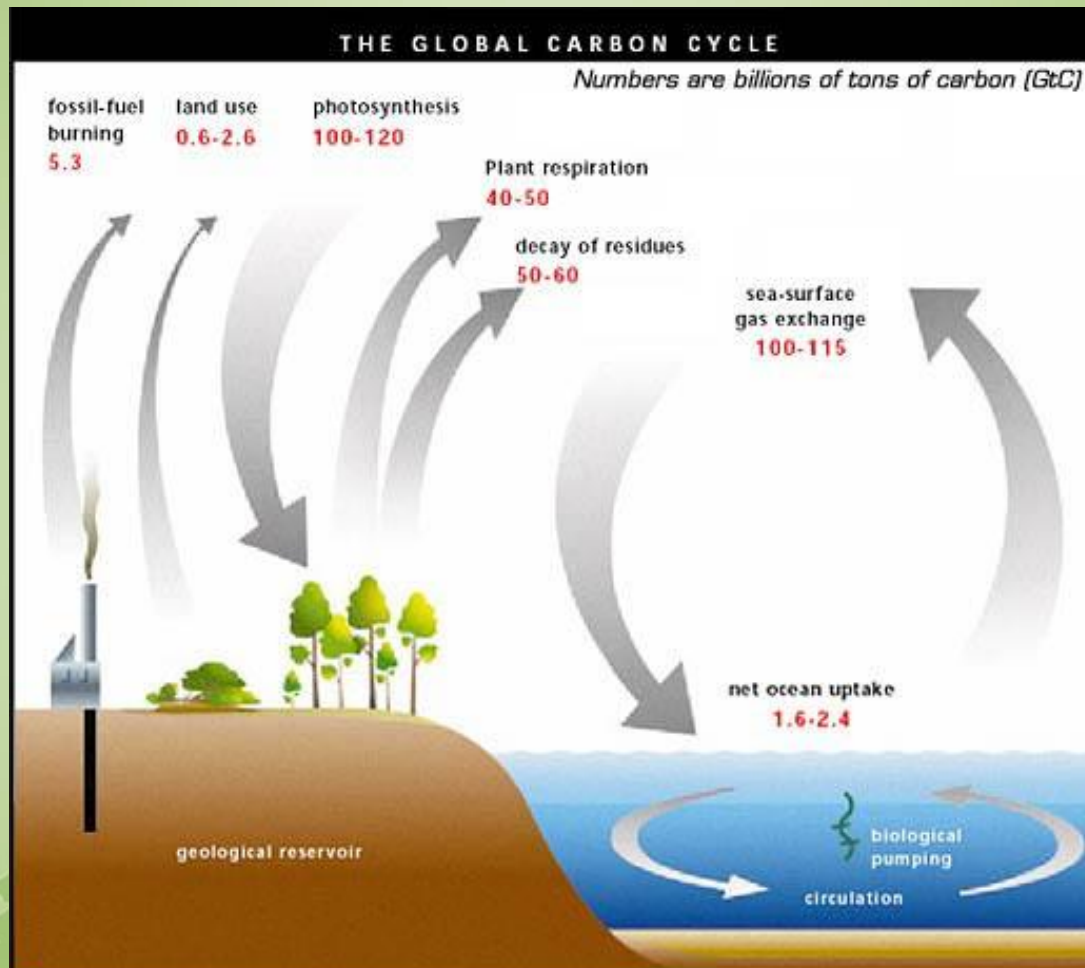


# More Potential Benefits

- Wood is a domestically plentiful renewable resource
- Can produce lower levels of sulfur, nitrogen, and heavy metals such as mercury than fossil fuels
- Useful way to process “waste wood”
- Carbon neutral
- Creates local jobs



# Understanding the Carbon Cycle



# Potential Concerns about Using Wood

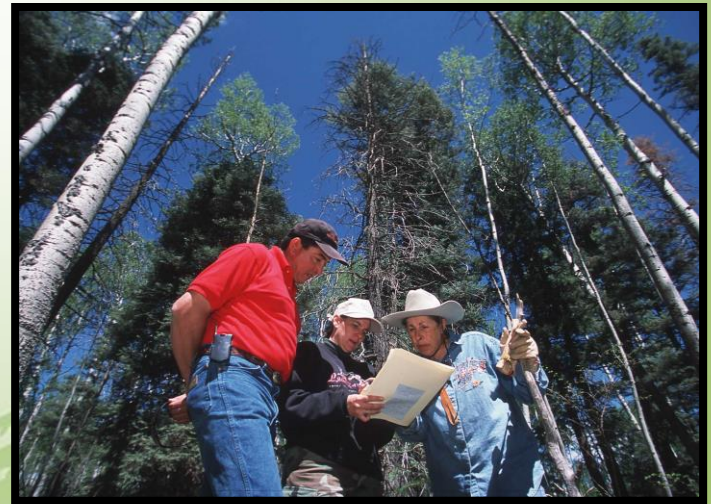
- Long term sustainable yields
- Reduced soil fertility
- Habitat change



# Potential Concerns about Using Wood

## Potential Solutions:

- Best management practices
- Sustainable forestry
- Forest certification





# Additional Concerns

- Unfamiliar technology
- Cost, compared to alternatives
  - \*although cheaper than other renewables



# Transporting and Handling Biomass

- Delivering energy, not volume or weight, is the objective
- Transport costs can exceed 50% of total costs
- Energy values are lower than most traditional wood markets—so the less handling the better



# Four Major Factors Influencing Transport Costs

1. Size reduction and method of loading
2. Moisture and ash content
3. Energy content in actual BTUs per dry ash-free pound
4. Payload capacities of transport vehicles



# Cost Assumptions for Wood Sources

## An Example

Cheapest



Most

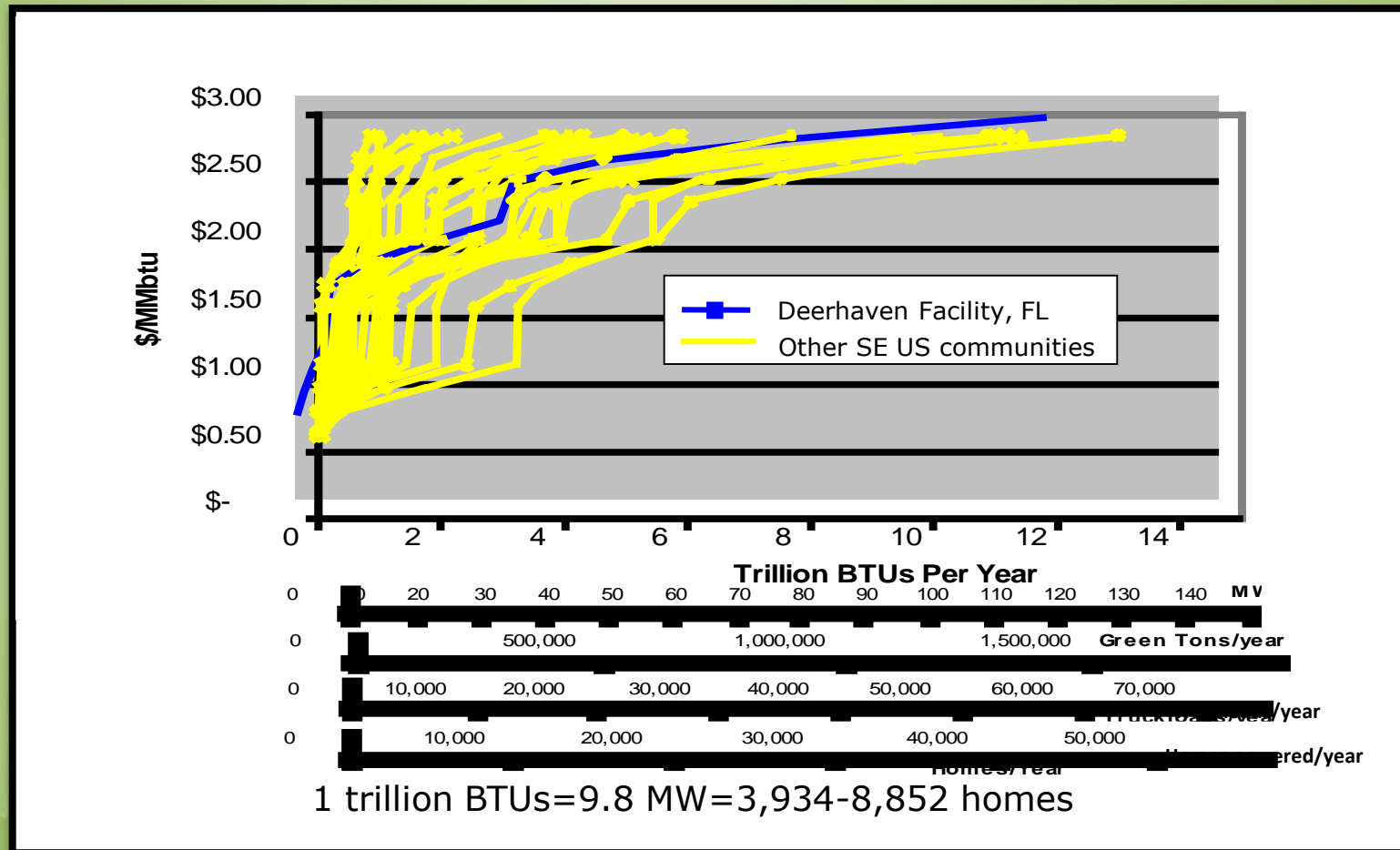
Expensive

Resource	Estimated purchase cost (\$/dry ton)
Urban Wood Waste	-\$25
Forestry Residues	\$0
Pulpwood	\$16

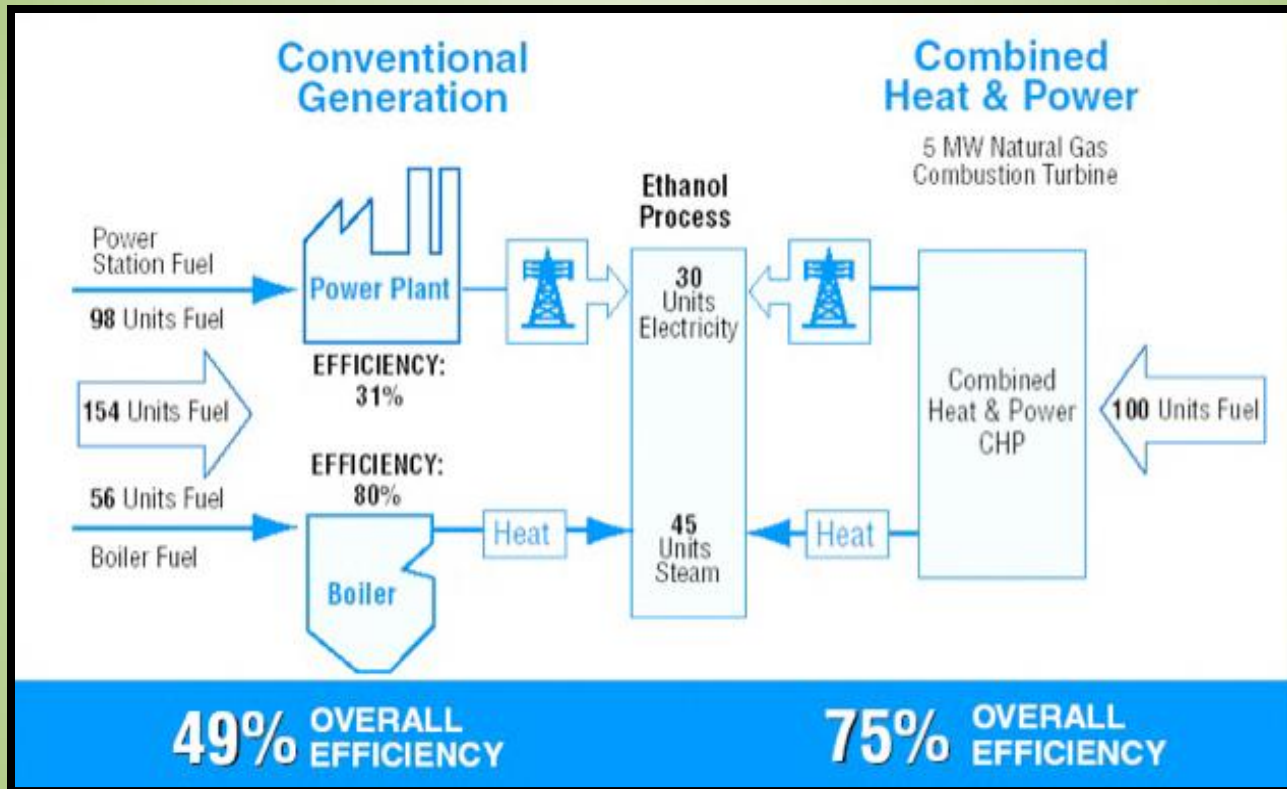
Harvest and process: \$20-\$30 per dry ton

Transportation: \$5-\$12 per dry ton

# Local Biomass Supply Curve



# Converting Wood into Energy



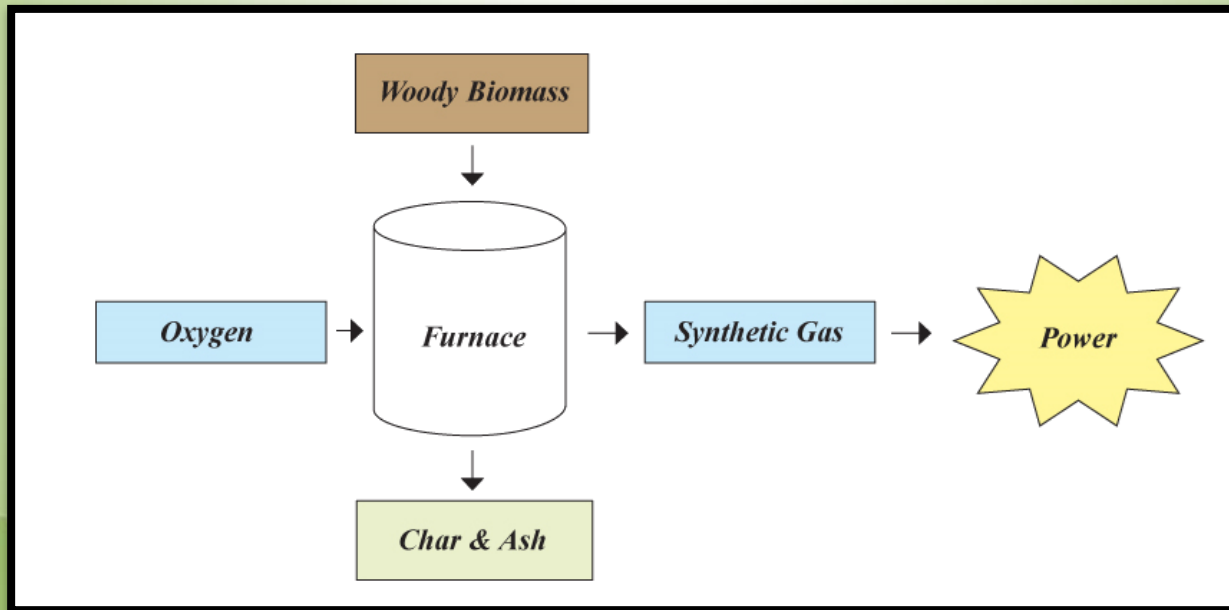
# Differences in Burners

- Coal systems much larger
  - Individual units 100 to 1000 MW
  - Typically pulverize the coal and burn it in suspension
- Biomass systems much smaller
  - Typically 1 to 50 MW
  - Typically burn on a grate



# Gasification

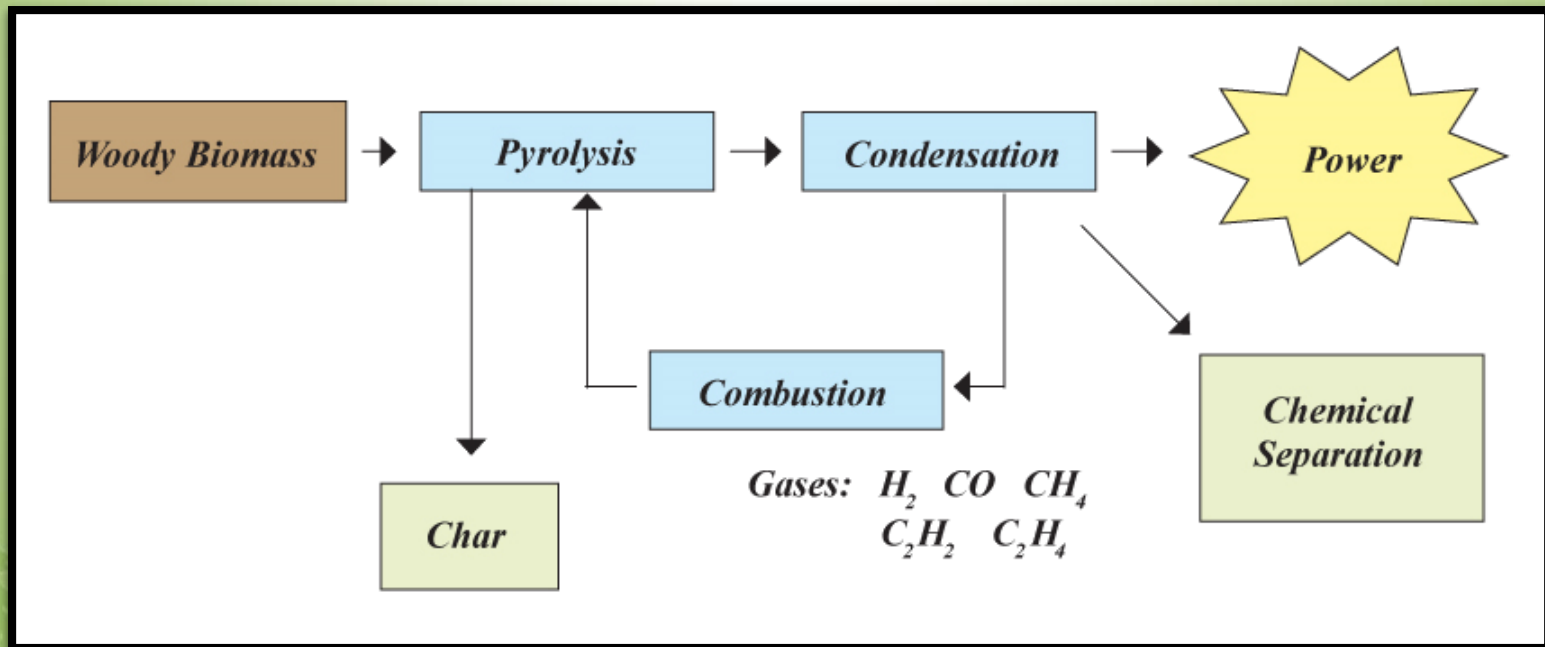
Gasification is a thermochemical process in which biomass at high heat is turned directly from a solid into a gaseous fuel called syngas (a mixture of carbon monoxide, hydrogen and some methane).





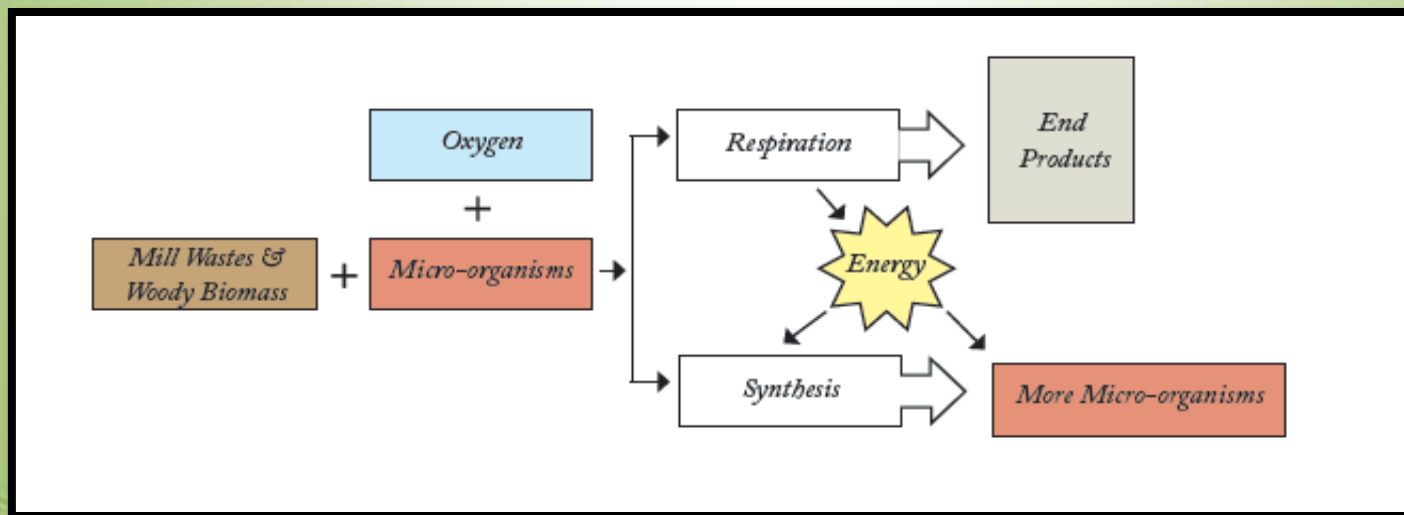
# Pyrolysis

Pyrolysis is the thermal degradation of organic components in biomass in the absence of oxygen. Major products are oil, gas, and char.



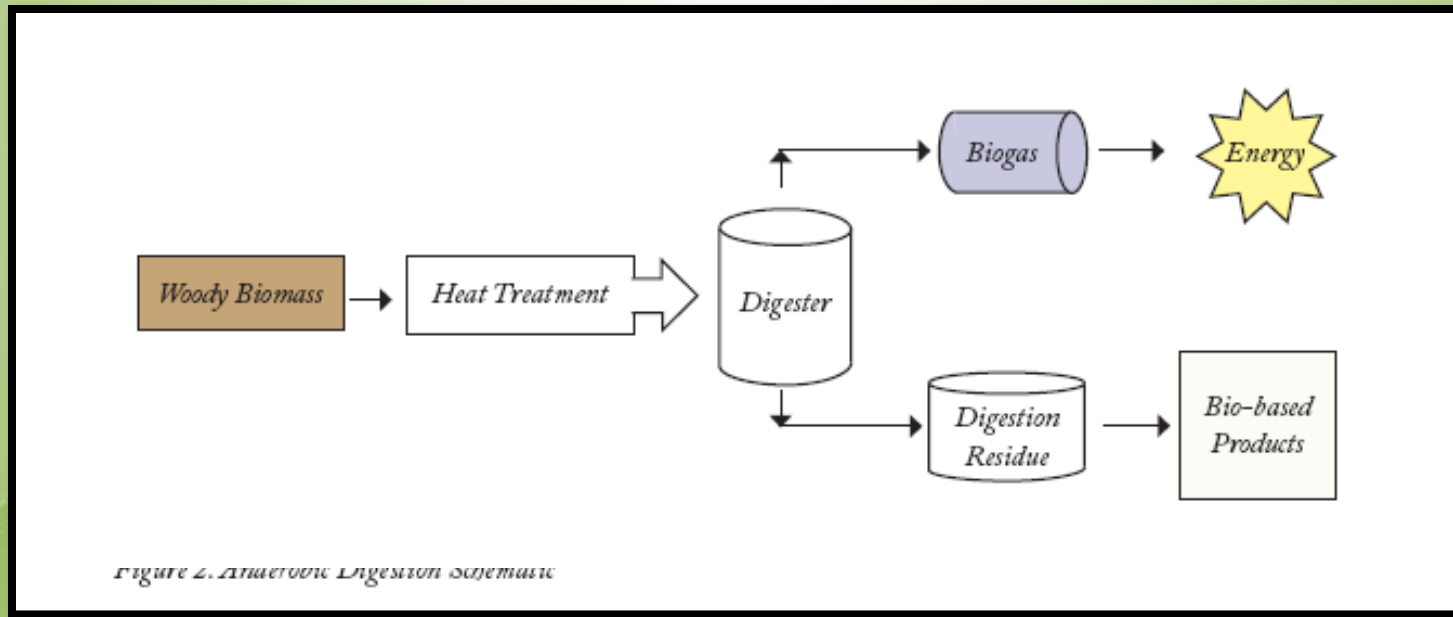
# Aerobic Digestion

Aerobic digestion is a process in which bacteria use oxygen to convert organic material into carbon dioxide. Products include nutrient-rich fertilizers and composts.



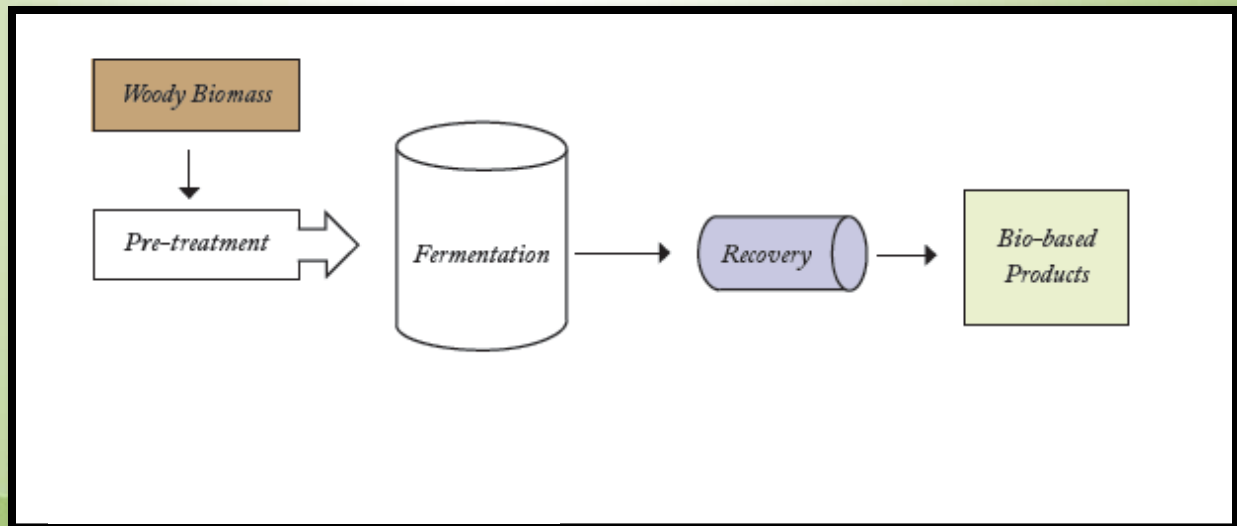
# Anaerobic Digestion

Anaerobic Digestion is the decomposition of biomass by bacteria in the absence of oxygen. Biogas, or methane, is the primary product produced.



# Fermentation

Fermentation is a biological process in which enzymes produced by microorganisms cause chemical reactions to occur. Products include ethanol, commercial levels of therapeutic and research enzymes, antibiotics, and specialty chemicals.



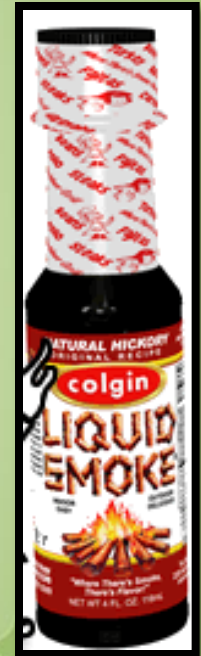
# Woody Biomass Products

- Fiber
- Building Materials
- Chemicals
- Fuels
- Food



# Bio-based Chemicals

- Non-petroleum based rubbers
- Medicines
- Enzymes
- De-icers
- Flavoring



# Bioenergy

Bioenergy can be electricity, heat, power, and transportation fuels.



Energy produced from biomass including woody biomass, agricultural biomass, and other biological materials

# Summary

Wood may be a viable option for the production of energy and other products in some communities.

As with any community decision, it is essential to carefully weigh and discuss potential benefits and costs and work towards an informed decision.



# Questions?



**\*Note: Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement implied.**