Electricity Generation

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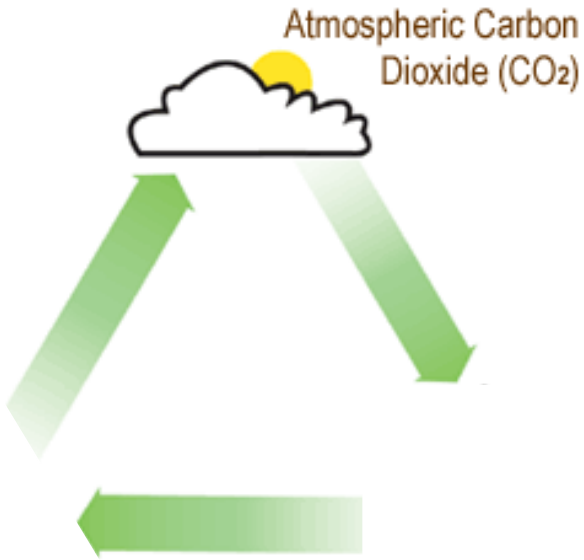
Why wood fuel?

- 24/7 base load electricity
- Clean combustion
- Proven technology
- Displacement of fossil fuel
- Carbon balance
- 4.9 jobs per MW

http://ucanr.org/woodybiomass

Why wood fuel?

- “Carbon neutral”



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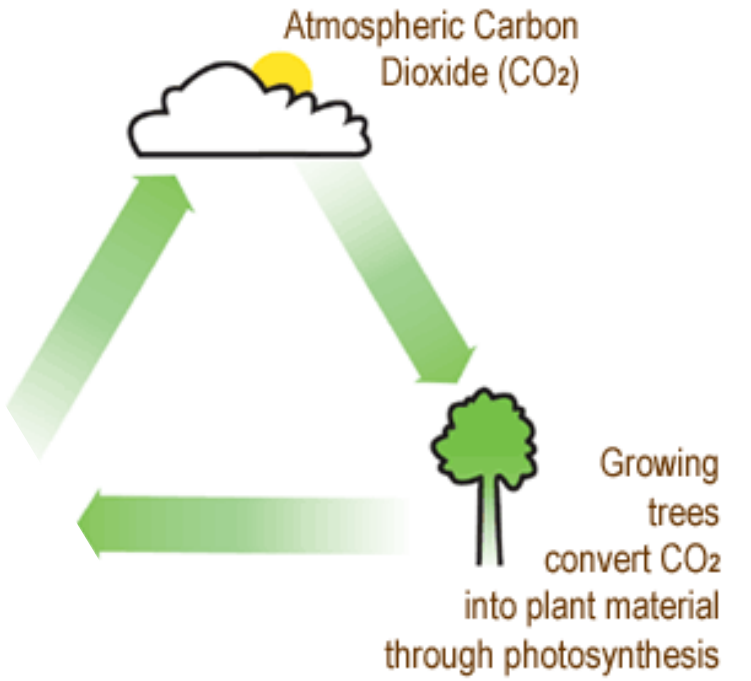

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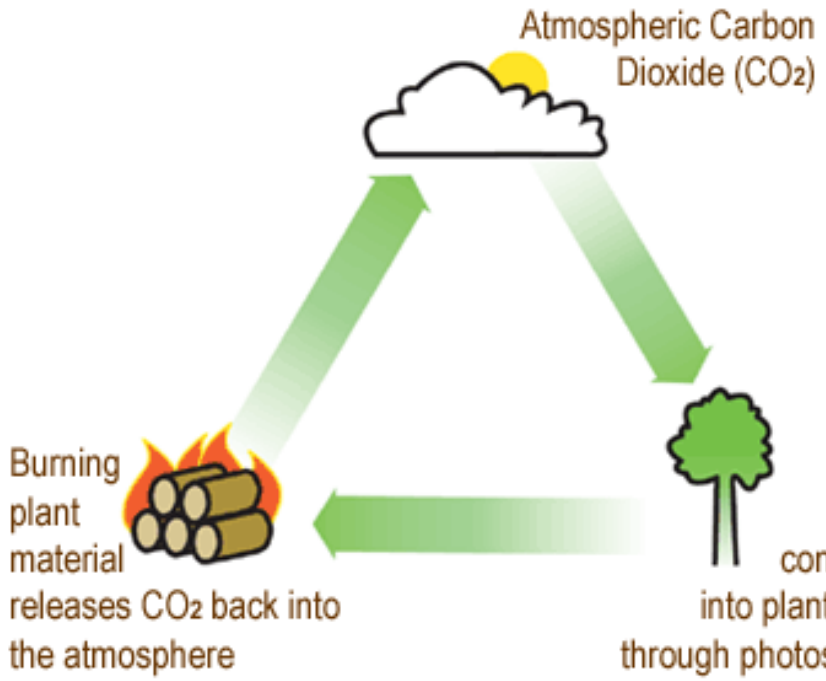

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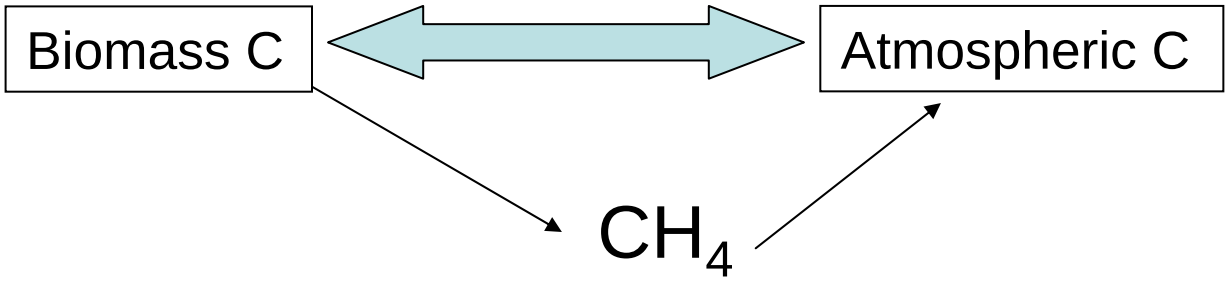
- Carbon can move within the biogenic system



- Carbon can be oxidized (CO_2) or reduced (CH_4)
- Methane is a significantly more potent greenhouse gas (GHG)

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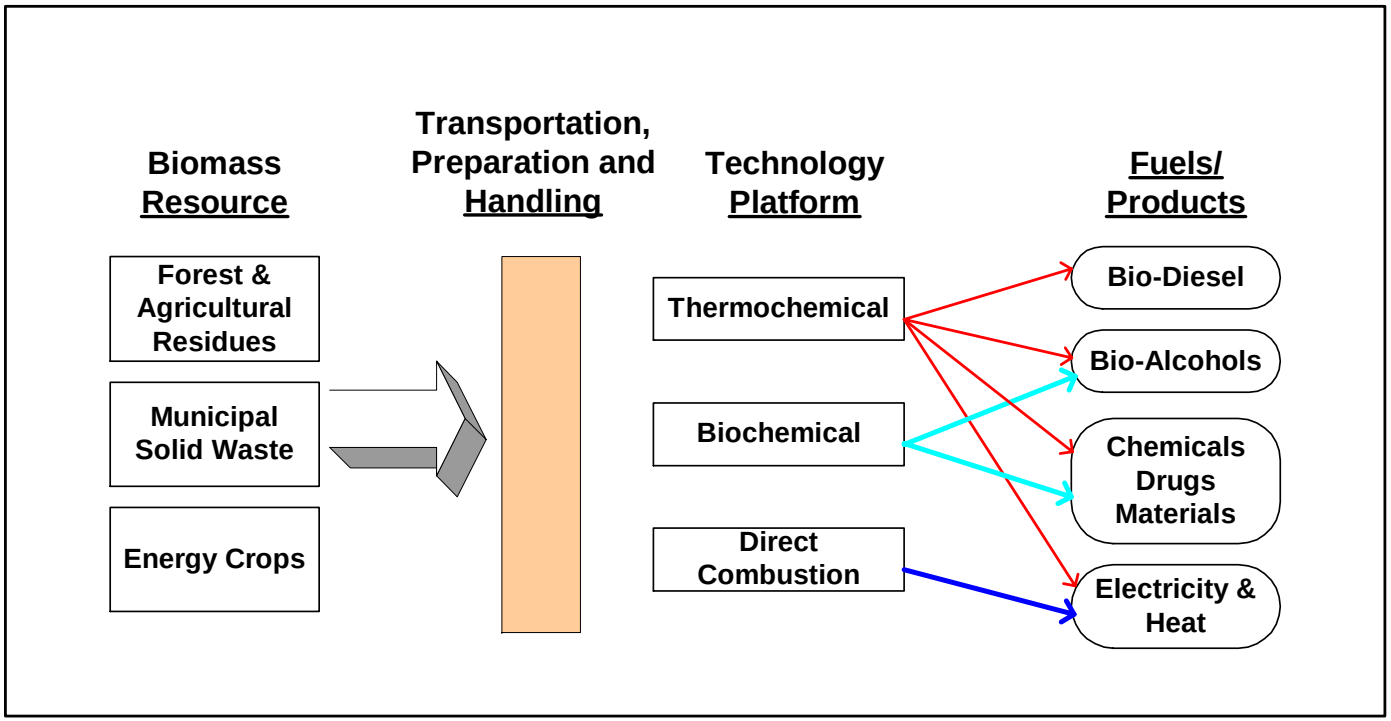
Conversion



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Biomass to electricity

Two main components:

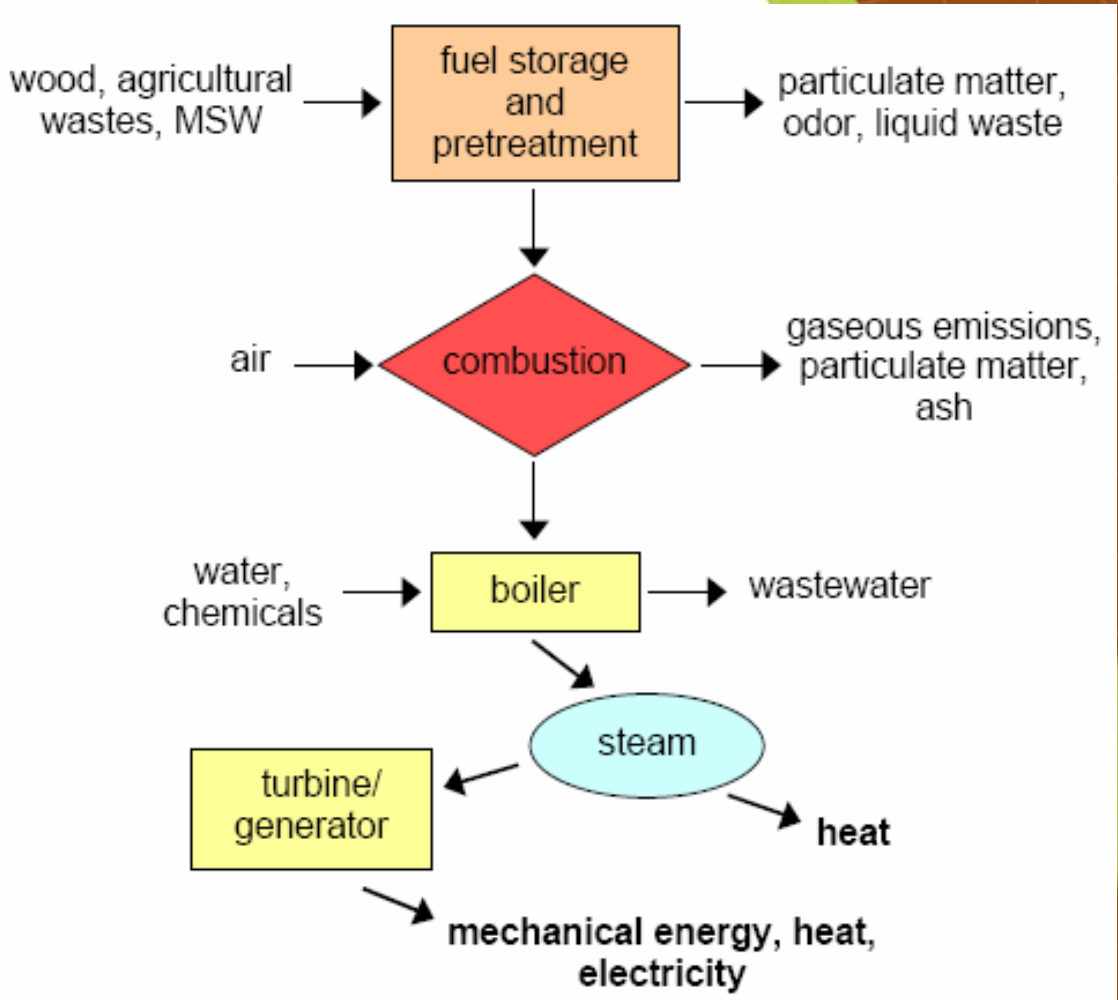
1. An energy conversion system that converts biomass to useful steam, heat, or combustible gases

2. A prime mover (turbine, engine, etc.) that uses the steam, heat, or combustible gas to produce power

Note: *Cogeneration or CHP is when you use the heat also*

Commercial-Industrial

direct combustion to produce steam to run turbine generators



Source: TSS Consultants

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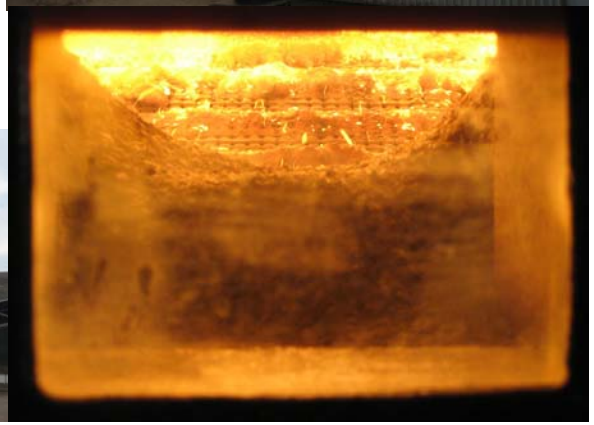
US biomass power

- 5-110MW (average 20MW)
- Installed cost $1700-$3500 per kW
- Most are combustion / steam turbine
- Most are grate stokers



Typical biomass power plant

- 20 MW plant provides electricity to 15-20,000 homes
- New plant construction cost = $50-60+ million
- Processes 160,000 tons/yr (1BDT/MW/hour burn rate)
- Biomass transported up to 50 miles
- Delivered biomass valued at $15– 60/BDT
- Average production cost ~ $0.07 - $0.10/kWh

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Relevant to SE Alaska?

- Probably not:
  - Cheap hydro
  - Low population
  - Limited electricity grid
  - Large scale

- Smaller scale (250kW to 3MW) - maybe
  - May have applicability to industrial sites or towns
  - Think about maintenance of high pressure steam systems

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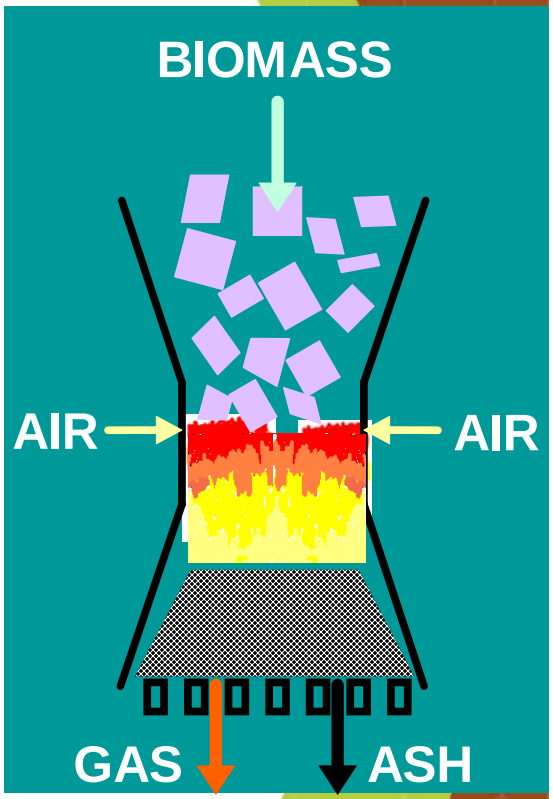
An alternative: gasification

- Biomass used to produce fuel gas (typically downdraft gasifier)
- Fuel gas (producer or synthesis gas) burnt in engine or micro-turbine to generate heat and electricity
- Smaller scale
- Could apply to off-grid areas



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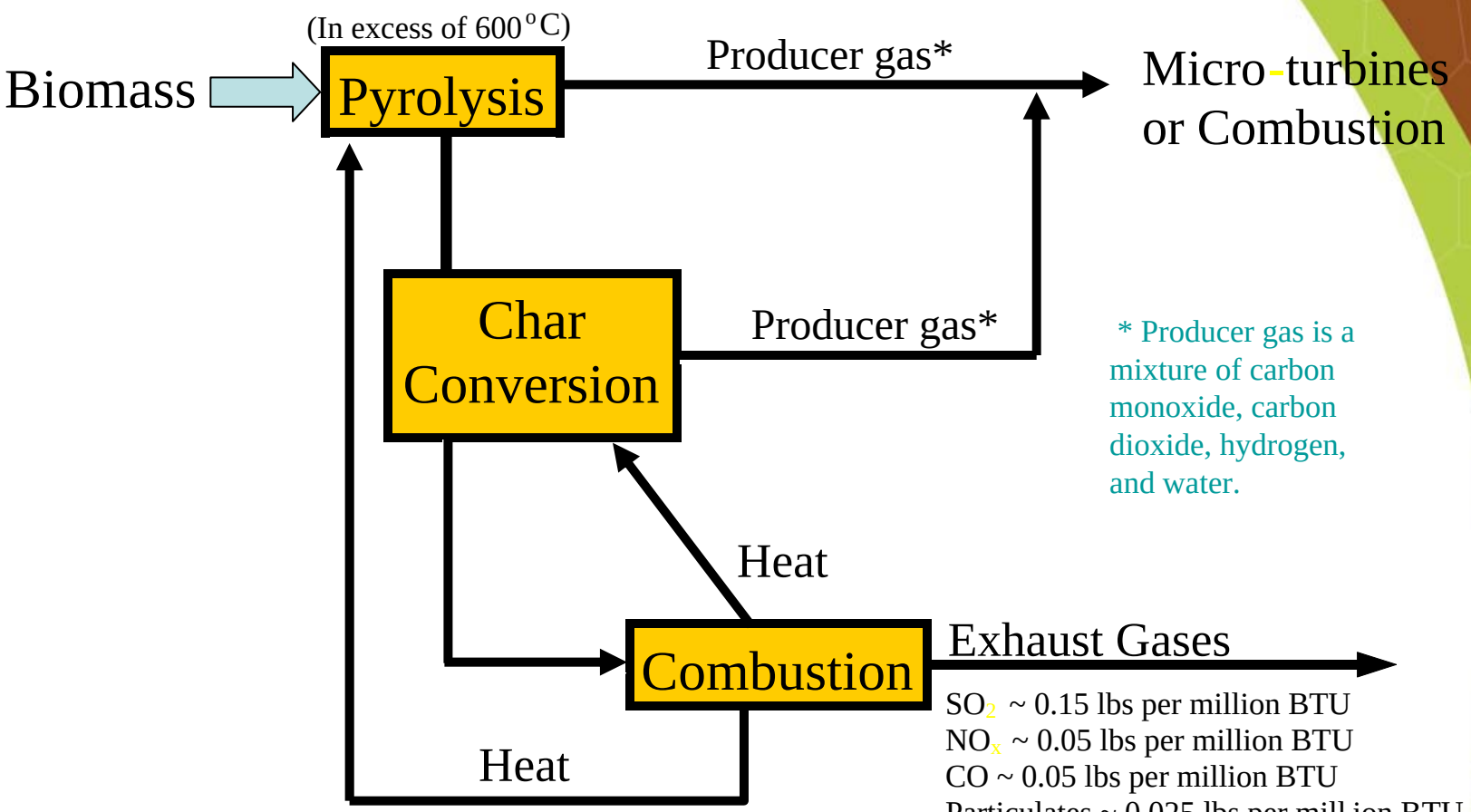
Gasification Process



* Producer gas is a mixture of carbon monoxide, carbon dioxide, hydrogen, and water.

SO_2 ~ 0.15 lbs per million BTU
NO_x ~ 0.05 lbs per million BTU
CO ~ 0.05 lbs per million BTU
Particulates ~ 0.025 lbs per mill ion BTU

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Gasifier flare

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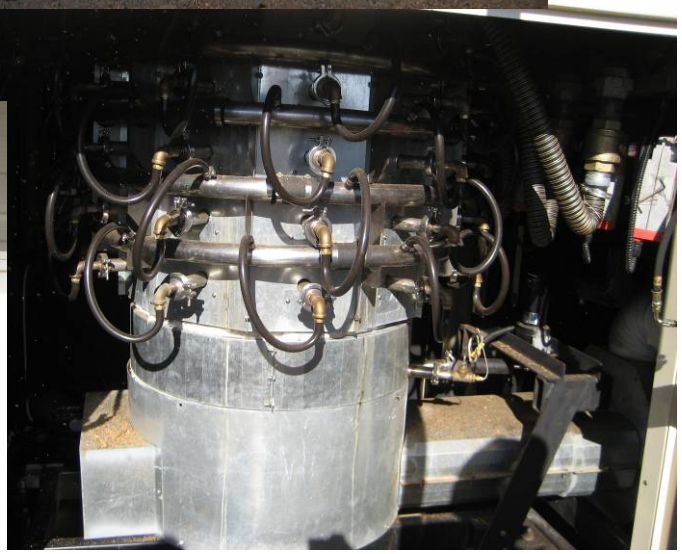
Fluidyne Pacific Class

CPC Biomax 50kW



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Biomass Engineering 250kW

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Gasification summary

- Costs $5,000-10,000/kWh installed (may make sense for off-grid areas)
- Operations and maintenance (who will do this)
- Fuel specification (can be picky)
- Reliability (sometimes…)

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