

Why (or Why Not) Biomass?

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"Energy from Wood – Exploring the Issues and Impacts for
North Carolina Conference"

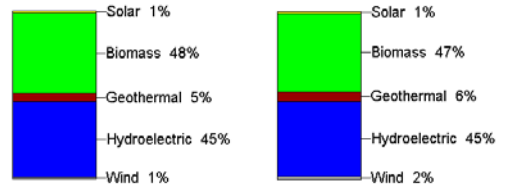
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Renewable Energy Consumption

6.294 Quadrillion Btus,
Year ????

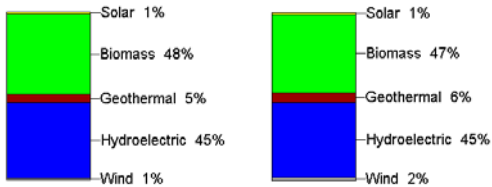
6.117 Quadrillion Btus,
Year ????



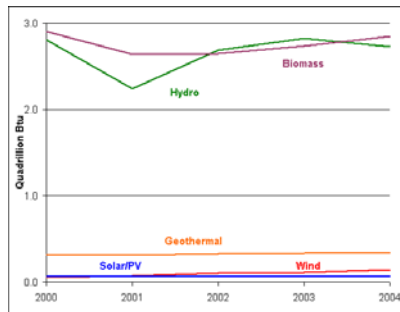
Renewables 1989 / 2004

6.294 Quadrillion Btus

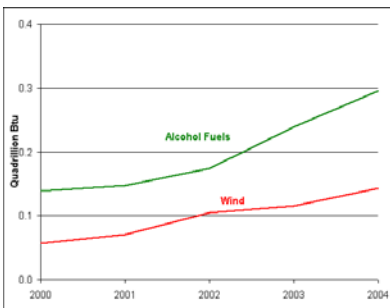
6.117 Quadrillion Btus



Where's the beef?



Wind and Alcohol Fuels



Characteristics of Renewables

- Highly site-specific
 - => potentially high transportation costs (electric grid, hauling)
 - => infrastructure issues
 - => detailed siting studies required

Characteristics of Renewables

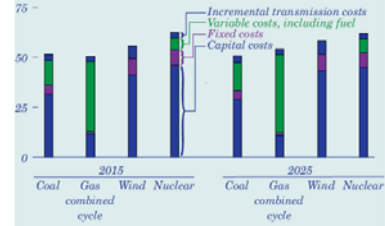
- Intermittent availability (wind, solar, PV)
=> back-up power required
=> value may be diminished

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Characteristics of Renewables

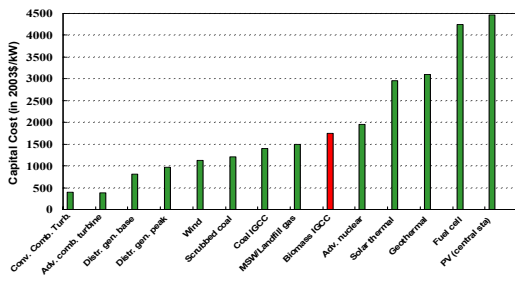
- Expensive, especially capital cost

Figure 71. Levelized electricity costs for new plants, 2015 and 2025 (2003 mills per kilowatthour)



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Capital Cost of Electricity Generating Technologies



Costs include contingency and technological optimism, but does not include regional multipliers
Source: EIA, "Assumptions to the Annual Energy Outlook 2005 (AEO2005)", April 2005, Table 38, p. 67

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Characteristics of Renewables

- Expensive, especially capital cost

Figure 77. Levelized and avoided costs for new renewable plants in the Northwest, 2010 and 2025 (2003 mills per kilowatthour)



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Characteristics of Renewables

- Small (except hydro)
- Low fuel costs (except biomass)
=> low risk
=> may be more desirable than more expensive plants when costs are adjusted for risk."

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Individual Renewables Characteristics

- **Biomass:**
Advantages
-- Widely varying resource base
-- Low-cost fuel – even negative
BUT... any alternative use generally commands a higher price
-- Eliminates a waste disposal problem

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Individual Renewables Characteristics

- **Biomass:**

- Disadvantages

- Fuel-handling
 - Very site-specific
 - Custom design
 - Potential pollutants
 - Major growth is in ethanol

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Individual Renewables Characteristics

- **Geothermal:**

- Advantages

- Low-cost when available
 - Minimal pollution
 - Both electricity and heat applications
 - Full-time availability
 - No fuel cost

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Individual Renewables Characteristics

- **Geothermal:**

- Disadvantages

- Resource often remotely located from grid
 - Resource depletion
 - Limited “liquid” resources

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Individual Renewables Characteristics

- **Photovoltaic:**

- Advantages

- Efficient
 - Pollution free (almost)
 - Load-following (generally)
 - Install at point-of-demand

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Individual Renewables Characteristics

- **Photovoltaic:**

- Disadvantages

- Space requirements
 - Very expensive
 - Intermittent, but largely predictable (diurnal)

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Individual Renewables Characteristics

- **Wind:**

- Advantages

- Pollution free
 - Efficient process
 - Large resource base
 - No fuel cost
 - PTC through 2015 = 63 GW additional

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Individual Renewables Characteristics

- Wind:

Disadvantages

- Resource often remotely located from grid
- Limitations on turbine erection (rebuild road)
- "Visual pollution?"
- Surges on grid
- Space requirements
- Growing rapidly, but still small

Renewables Outlook

- Biomass, Wind, and Geothermal Lead Growth in Renewables

Figure 64. Nonhydroelectric renewable electricity generation by energy source, 2004-2030 (billion kilowatthours)

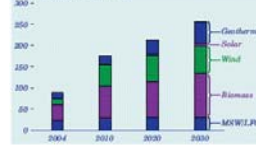
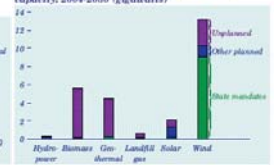
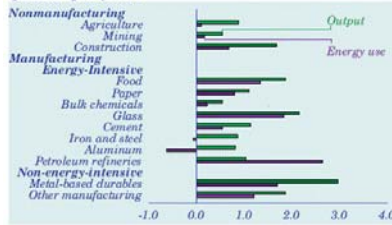


Figure 65. Additions of renewable generating capacity, 2004-2030 (gigawatts)



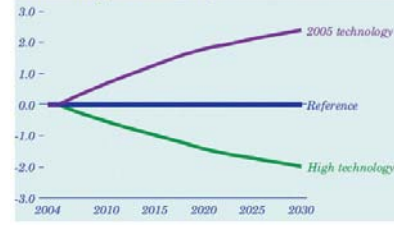
Energy-Intensive Industries Grow Less Rapidly Than Industrial Average

Figure 46. Average growth in industrial output and delivered energy consumption by sector, 2004-2030 (percent per year)

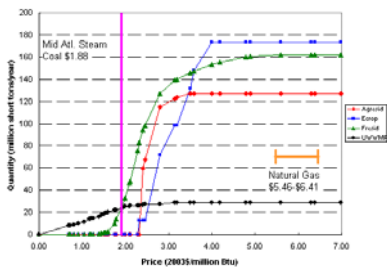


Alternative Technology Cases Show Range of Industrial Efficiency Gains

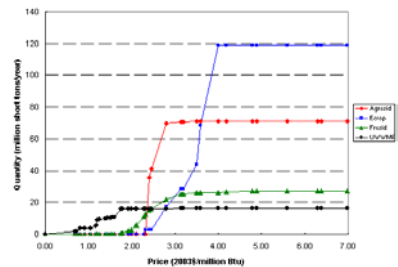
Figure 48. Variation from reference case delivered industrial energy use in two alternative cases, 2004-2030 (quadrillion Btu)



Quantities of Biomass Available, US



Quantities of Biomass Available, South Atlantic



WARNING !

- The following material is the **opinion** of the author

Outlook for Energy Use in the Paper and Pulp Industry

- More electricity, less process heat (due to new technologies)
- Continued increase in use of self-generated fuels (40% in 1970s to 60% today)

- Black liquor** -- (895 trillion Btu)

Quantity of fuel <u>Generated</u>	Quantity of fuel <u>Consumed</u>
flat	flat

Factors -- BLG at kraft pulp mill (up) vs. mill closures (down)

- Wood residuals** -- (327 trillion Btu)

Quantity of fuel <u>Generated</u>	Quantity of fuel <u>Consumed</u>
Up	Up

Factors Causing:

<u>Increased Consumption</u>	<u>Decreased Consumption</u>
------------------------------	------------------------------

- | | |
|---|---|
| <ul style="list-style-type: none"> Increased fossil fuel prices (EIA shows 0.3%/yr thru 2030) Renewable fuel financial incentives Successful wood gasif. | <ul style="list-style-type: none"> Lower fossil fuel prices, esp. natural gas Competition for biomass (e.g., utilities) |
|---|---|

- Pulp & Paper WWT sludge** -- (3.9 million tons)

Quantity of fuel <u>Generated</u>	Quantity of fuel <u>Consumed</u>
Up	Up

Factors Causing:

Increased Consumption

- Same as for wood resid., plus:
- Increased use of recycled fiber in papermaking
- Decreasing landfill space

Decreased Consumption

- Same as for wood resid., plus:
- Competition for sludge (e.g., asphalt roofing)

Conclusions

- Renewable energy, while more competitive, is still generally a higher cost source than conventional fuels.
- The paper and pulp industry is gradually switching to technologies requiring more electricity and less process heat.