

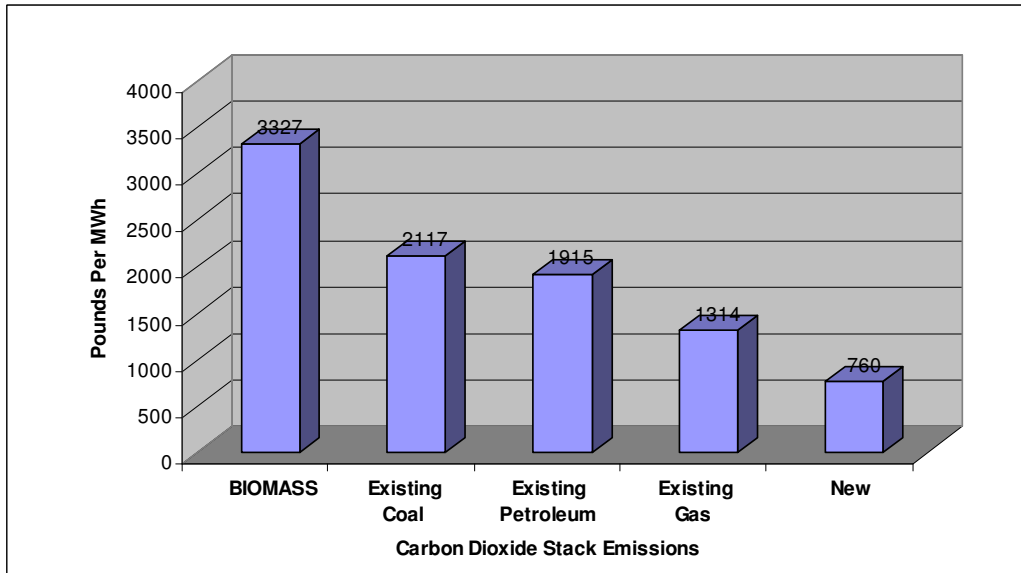
WOOD-FUELED BIOMASS POWER PLANTS AND CO2 EMISSIONS

Biomass is typically touted as a carbon neutral fuel and burning biomass is sold as “green” energy. The key assumption about carbon neutrality is unsubstantiated and impossible, yet is still repeated by biomass proponents. In fact, wood fueled biomass power plants are worse than coal for carbon dioxide emissions.

Russell Biomass in Massachusetts is one such proposed facility. The project proponents estimate in their expanded environmental notification form that the plant will emit 1,732 tons per day of carbon dioxide to produce 380,000 MWh of power annually, an emission rate of **3,327 lbs/MWh**¹. For comparison carbon dioxide emission rates are 2,117 lbs/MWh for existing coal plants, 1,314 lbs/MWh for existing gas plants and 760 lbs/MWh for new power plants.² The Russell plant would emit 50% - 250% more carbon dioxide per unit of energy produced than the top ten worst carbon dioxide emitting power plants in the northeast.³

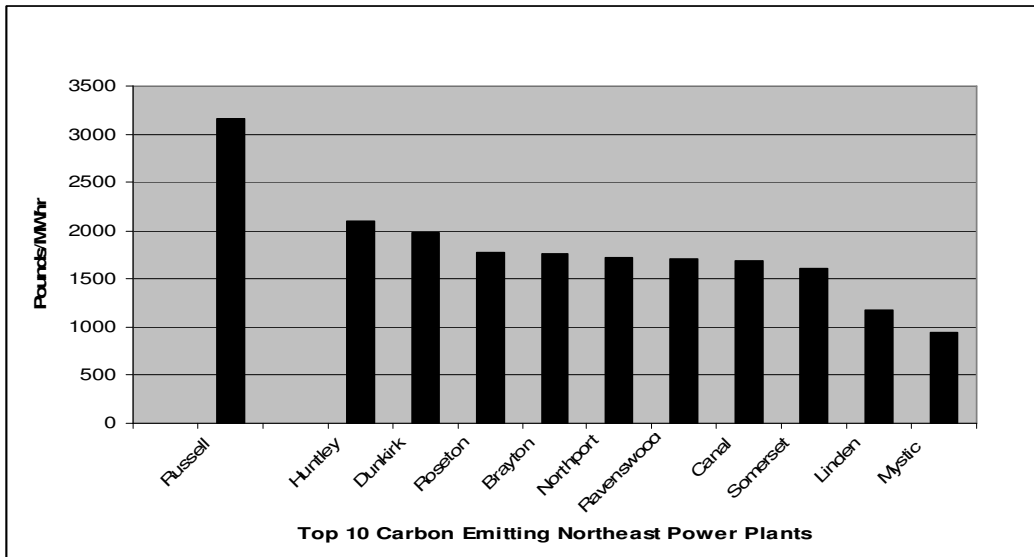
Overall, wood fueled biomass power plants emit about 50% more CO2 per MWh than existing coal plants, 150% more than existing natural gas plants and 330% more than new power plants.⁴

WOOD FUELED BIOMASS vs FOSSIL FUEL POWER PLANTS



Source: Department of Energy and Footnotes 1 & 2

RUSSELL BIOMASS vs WORST NORTHEASTERN POWER PLANTS



Source: MassPIRG “More Heat than Light” and footnote 1

While beyond the scope of this briefing, additional carbon impacts from wood fueled biomass power plants must be added since the forest's ability to sequester carbon has been reduced through logging. A full accounting of carbon dioxide impacts from wood fueled biomass power plants would also include carbon emissions from the decay of forest root systems, oxidation of soil organic material as well as the use petroleum for logging of forests, chipping the wood, and hauling a large quantity of relatively small fuel loads at distances up to 100 miles or more in trucks that get about 5 miles per gallon.

It is impossible for a biomass power plant that burns existing forests to be carbon neutral since any increase in forest cutting negatively affects the *current baseline condition* of forest growth versus cutting and mortality and reduces the baseline amounts of carbon sink provided by the forest. Carbon neutrality of a project would require no net change to this ratio.

Footnotes

- 1 Tighe & Bond. 2005. Expanded Environmental Notification Form, Russell Biomass Project, September 2005. p. 3, 12
1732 tons CO2 per day x 365 = 632,180 CO2 tons per year, 380,000 MWh per year,
 $632,000 \times 2000 \text{ lbs/ton} / 380,000 = \underline{\mathbf{3,327 \text{ lbs of CO2 per MWh}}}$

Back check: $380,000/365 \text{ days} / 24 \text{ hours} / 50 \text{ MW} \times 100\% = 86.7\% \text{ uptime}$

1 MW Requires 13,000 green tons at 45% moisture content and 90% up time, see page 11:

<http://www.mass.gov/Eoeea/docs/doer/renewables/biomass/bio-08-02-28-wmass-assess.pdf>

$50 \text{ MW} \times 13,000 \text{ green tons (at 90\% up time)} \times 86.7\% / 90\% \times 1.01 \text{ tons carbon per green ton} = 632,000 \text{ tons CO2}$ **OK**
(Note: see calculation below for carbon weight calculation of 1.01 tons.)

Triple Check – Theoretical Calc for 1 MW

online % = 90% → kWh operation = 7,884,000

typical plant efficiency = 0.24, 1 kWh = 3413 Btu → Btu = 112,117,050,000

moisture content 0.45 → btu/lb = 4,575 → Wood per year → 12,253 green tons/year

1 green ton @45% moisture = 0.55 dry tons

50% of weight is carbon = 0.275 tons of carbon per green ton

$\text{CO2} = 12 + 32 = 44/12 = 3.67 \rightarrow 1.01 \text{ tons of carbon dioxide per green ton @ 45\% moisture}$

→ Carbon dioxide released 12,367 tons / year

CO2 Release Rate = 3,137 lbs CO2 per MWh **OK +- 5%**

- 2 Department of Energy, Table-1 www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf
Coal = 2,117 lbs CO2 per MWhr Petroleum = 1,915 lbs CO2 per MWhr Gas = 1,314 lbs CO2 per MWhr
New power plants average 760 lbs CO2 per MWh, see page 2:
<http://conedisonsolutions.com/factsheets/MA%20Jan%202010.pdf>
Biomass = 3,327 lbs per MWhr (see footnote 1)

- 3 Massachusetts Public Interest Research Group. 2005. "More Heat than Light." p 1
www.policyarchive.org/bitstream/handle/10207/5503/NE-More%20Heat%20Than%20Light%20text%20%2b%20cover.pdf?sequence=1

- 4 Biomass/Coal = $(3,327-2,117)/2,117 = 57\%$ Biomass/Gas = $(3,327-1,314)/1,314 = 153\%$
Biomass/New Power Plants = $(3,327-760)/760 = 338\%$

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February 27, 2010

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