MASSACHUSETTS FOREST WATCH

WOOD-FUELED BIOMASS POWER PLANTS AND CO2 EMISSIONS

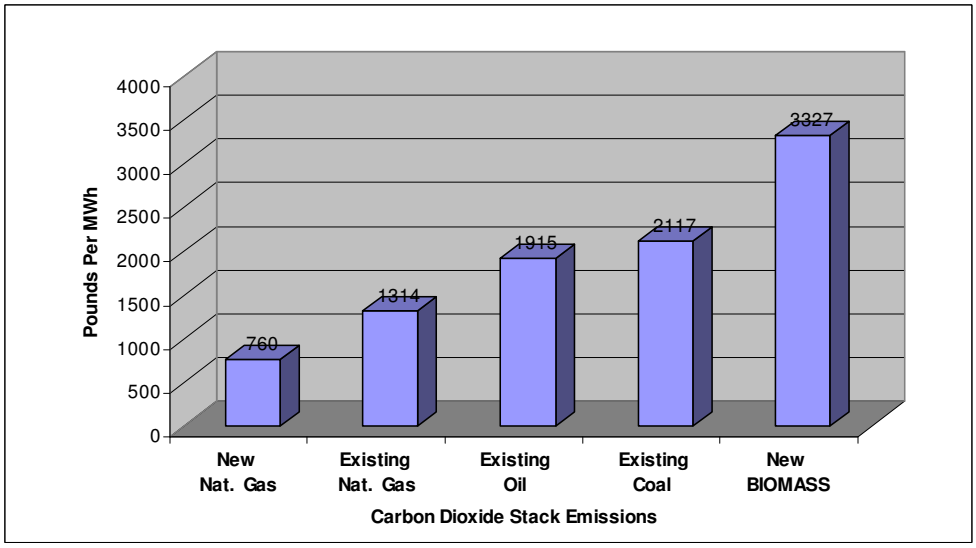
www.maforests.org/MFWCarb.pdf

Biomass is often touted as a "carbon neutral" fuel and burning biomass is sold as "green" energy. This "carbon neutrality" myth has been debunked by science, yet is still repeated by biomass proponents. In fact, wood fueled biomass power plants are worse than fossil fuels 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]

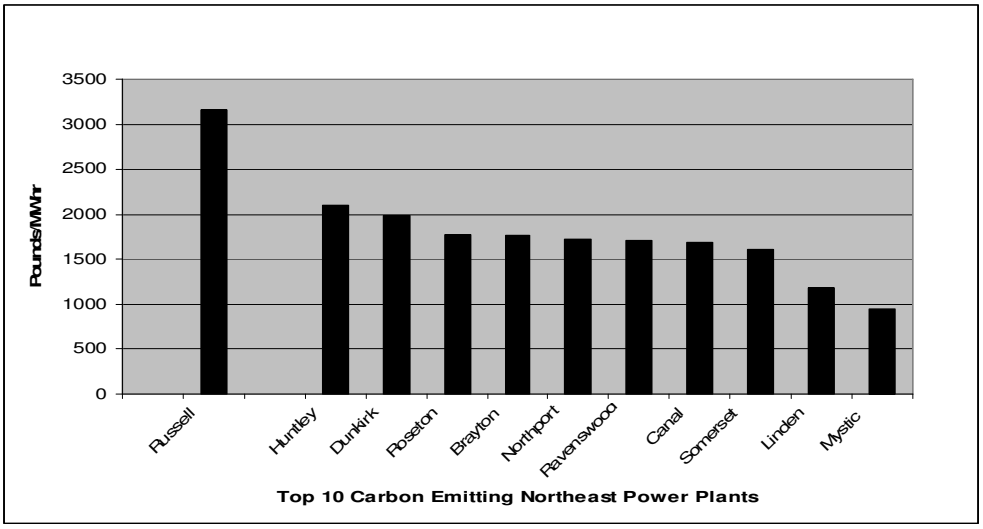
Overall, new wood fueled biomass power plants emit about 50% more CO2 per MWh than existing coal plants, 150% more than existing natural gas plants and 330% more than new gas power plants.[4]

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

Even the often touted idea of converting existing fossil fuel heating systems or CHP systems to wood fueled biomass increases carbon dioxide emissions by 26% over oil and 74% over gas given similar efficiencies.[5] Since wood burners are usually less efficient, actual carbon emission increases would be even higher.

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. Furthermore, it is the overall carbon emission input rate into the atmosphere from an energy source that matters, because overall carbon sequestration rates can not be expected to increase to make up for increased carbon inputs. With biomass burning of existing trees, the overall sequestration rate may even decrease because of the impacts on the forest, creating a double whammy.

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 x 2000 lbs/ton /380,000 = **3,327 lbs of CO2 per MWh**

Back check: 380,000/365 days / 24 hours / 50 MW x 100% = 86.7% 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 MW x 13,000 green tons (at 90% up time) x 86.7 % / 90% x 1.01 tons carbon per green ton = 632,000 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
→ CO2 = 12 + 32 = 44/12 = 3.67 → 1.01 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: www.colonialpowergroup.com/documents/MarlboroughDisclosureLabel.pdf
Biomass = 3,327 lbs per MWhr (see footnote 1)

3 Massachusetts Public Interest Research Group. 2005. "More Heat than Light." p 1
www.environmentmassachusetts.org/uploads/90/c0/90c011ba2b26309987e273cd9c34d2b8/moreheatthanlight.pdf

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%

5 Carbon per unit of energy (tonnes/TJ): Wood= 25, Oil= 19.9, Gas= 14.4, http://bioenergy.ornl.gov/papers/misc/energy_conv.html
Note: Convert energy of dry wood → 20 GJ/tonnes = .05 tonnes/GJ → 50% carbon → .025 tonnes/GJ = 25 tonnes C /TJ

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March 24, 2010