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Executive Summary

According to a 2007 report by the Massachusetts Department of Energy Resources, there are plans to eventually build of at least 165 megawatts (MW) of large-scale woody biomass electricity generation capacity in Massachusetts. As of autumn 2009, in addition to the existing Pinetree plant in Westminster (17 MW), there are three new plants in the permitting process, representing 135 MW of generation:

- Russell Biomass (50 MW; Russell, MA)
- Pioneer Renewable Energy (47 MW; Greenfield, MA)
- Palmer Renewable Energy (38 MW; Springfield, MA)

The Russell and Greenfield plants would burn primarily forest biomass; the Springfield plant would burn about 80% construction and demolition debris (CDD). At 135 MW, the combined generation capacity of the three plants would constitute less than 1% of Massachusetts's electricity generation capacity.

A 30 – 50 MW plant has also been proposed in Pittsfield, and has received a development grant from the Massachusetts Technology Collaborative. Additionally, a proposal to convert the 120 MW Somerset coal to burn up to 100% CDD is under consideration by the Massachusetts Department of Environmental Protection (MassDEP).

Biomass plants are being promoted by the state to meet the renewable energy generation goals set by the Global Warming Solutions Act, the Green Communities Act, and the Regional Greenhouse Gas Initiative (RGGI). Biomass power is considered to be "carbon neutral", based on the assumption that wood grows back and resequesters carbon released by burning, so it looks like an attractive solution to meeting the region's renewable energy needs. However, the plants that are being proposed would have significant impacts on forest resources, water resources, and greenhouse gas and air pollution emissions in western Massachusetts. The proposed plants would:

- Require a fuel supply equivalent to at least quadrupling the number of acres of forest cut yearly in Massachusetts
- Require evaporating close to 2 million gallons of water daily from rivers and drinking water systems to meet plant cooling and boiler flushing needs
- Increase ozone-forming NOx emissions by 11% over recent emissions in Franklin, Hampshire, and Hampden counties
- Increase particulate matter emissions from stationary sources by 25%
- Increase Hazardous Air Pollutants (HAPs) from stationary sources by 13%
- Increase mercury emissions from stationary sources by 11%
- Increase lead, arsenic, hexavalent chromium, and dioxin emissions significantly, with emissions levels close to EPA and DEP health thresholds
- Increase air pollution in at least two environmental justice communities, one of which, Springfield, already has childhood asthma and blood lead levels significantly higher than the state average
- Require millions of gallons of diesel fuel for harvest and transport of wood fuel, releasing additional tons of CO2, NOx, and dangerous diesel particulate matter
- Degrade forests as providers of climate regulation, habitat, and clean water
- Increase CO2 emissions from the power generation sector, just when there is the greatest need to reduce emissions.
- All while providing only about 1% of electricity generation in Massachusetts and while taking funding and renewable energy credits away from truly renewable and clean technologies like wind and solar energy

Background

Three large-scale biomass plants are in the permitting process in Massachusetts. If built, they will have significant forest cutting, greenhouse gas, and air pollution impacts. The purpose of this document is give an overview of some of these impacts, summarizing information from a variety of sources.

What is biomass power?

Biomass power involves the combustion of wood or anything else defined as biomass to generate energy (definitions of biomass vary state to state, and can include municipal waste and tires). While there is no fixed definition for the scale of biomass plants, most existing plants and current proposals seem to fall either in the small-scale plant category of less than one megawatt to about 2 megawatts, and the "large-scale" category, ranging from 10 – 60 megawatts (MW). The largest plants operate at about 24% efficiency, unless they recover and utilize waste heat, increasing their efficiency. Small-scale plants sometimes are operated for combined heat and power (CHP), which can increase plant efficiency to 70 – 80%. Some small plants are operated for thermal energy, only, providing steam to a building or building complex. Some plants utilize gasification technology which combusts biomass at low oxygen levels to generate burnable gas.

As of October 2009, there are three large-scale biomass electricity plants currently in the environmental review/permitting process in Western Massachusetts,[1] none of which would recover waste heat. These are

- Russell Biomass (50 MW; Russell, MA)
- Pioneer Renewable Energy (47 MW; Greenfield, MA)
- Palmer Renewable Energy (38 MW; Springfield, MA)

A further 30 – 50 MW plant has been proposed in Pittsfield, and has received a $250,000 development grant from the Massachusetts Technology Collaborative, as did the Russell, Greenfield, and Springfield plants. There is also a proposal under consideration by the Massachusetts Department of Environmental Protection (MassDEP).to convert the 120 MW Somerset coal plant to a gasification system that can burn CDD and "recycled paper cubes" as well as coal. There is little information available on the impacts of these two projects, however, thus the discussion in this document is mostly limited to the three plants that are furthest along in the permitting process.

The plants proposed for Russell and Greenfield will burn primarily green wood from forests. The Springfield plant (Palmer Renewable Energy) will derive about 20% of its power from forest biomass and 80% of its power from construction and demolition debris (CDD), with only part of

[1] Russell Biomass submitted a Environmental Impact Report (EIR) to the Massachusetts Environmental Policy Act (MEPA) office. However, the Greenfield and Springfield plants fell just short of triggering thresholds for submission of an EIR, at least on paper, and were both allowed to exit the MEPA review process having submitted only the preliminary document, an Environmental Notification Form (ENF). ENF's for both plants were fairly detailed, but because no EIR's were required, substantive questions that were raised during the ENF review process remain unanswered.

the CDD to be sourced from Massachusetts and the balance from other states, including Maine.[2] Somerset Power has also filed plans with the Massachusetts Department of Environmental Protection to amend its emissions control plan for the net 120 MW Somerset coal plant to permit it to burn up to 100% CDD.[3] The Somerset plant would use gasification technology, which produces lower pollutant emissions than direct combustion, but does not reduce greenhouse gas emissions. Construction and demolition debris fuel for the Somerset plant will likely be barged in from out of state, although some might be generated in-state.

Why biomass is being incentivized

Like the other states operating under the northeastern Regional Greenhouse Gas Initiative (RGGI) compact, Massachusetts is obligated to reduce greenhouse gas emissions from the power generation sector 10% by 2018.[4] Within the state, the Green Communities Act (2008) mandates that 20% of the State's electric supply come from renewable sources by 2020. Although international greenhouse accounting convention acknowledges that it can take decades to "re-sequester" carbon released by burning biomass into new growth,[5] biomass energy is not only treated as renewable, but also as "carbon neutral" under current Massachusetts regulations and RGGI accounting, so that greenhouse gas emissions produced by biomass combustion are invisible to the regulatory process.[6] This accounting convention makes large-scale biomass an attractive option on paper meeting greenhouse gas reduction goals, especially since it is a more concentrated form of electricity generation than wind or solar power. However, since it is impossible that the large amount of CO2 released by large-scale biomass plants to be re-sequestered into new growth in time to meet greenhouse gas reduction deadlines, reductions in emissions in fact do only exist on paper, and not in reality.

Renewable Energy Credits

The definition of biomass as renewable and carbon neutral is integral to the financial viability of large-scale biomass plants. Biomass power is fairly expensive to generate, but as a renewable energy source, biomass plants are eligible to receive Renewable Energy Credits (RECs) for every megawatt-hour of electricity that they generate, which they then sell to power providers who are obligated to purchase a certain amount of energy from renewable sources. The REC's can be sold separately from the power itself, which is fed into the grid and becomes indistinguishable from power generated from conventional sources. RECs thus essentially serve as a demonstration that a certain amount of power has been generated from renewable sources. There

[2] Epsilon Associates. Major Comprehensive Air Plan Approval Application for Palmer Renewable Energy Project, revised June 29, 2009.

[3] Emission Control Plan Approval filing for Somerset Power LLC, April 13, 2009, from AECOM Environment to John Winkler, Massachusetts Department of Environmental Protection.

[4] RGGI website: http://www.rggi.org/about

[5] Intergovernmental Panel on Climate Change, 2006. IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4: Agriculture, Forestry, and Other Land Use. Chapter 4: Forest lands.

[6] This convention is likely based on EPA's decision to not require reporting biogenic greenhouse gases in its national accounting. Interestingly, this approach is at odds with the recent EPA endangerment finding on CO2 and other greenhouse gases, which does not distinguish among sources of CO2. It states that "Indeed, for a given amount of CO2 released today, about half will be taken up by the oceans and terrestrial vegetation over the next 30 years, a further 30 percent will be removed over a few centuries, and the remaining 20 percent will only slowly decay over time such that it will take many thousands of years to remove from the atmosphere." (Federal Register, April 24, 2009. Environmental Protection Agency 40 CFR Chapter 1: Proposed endangerment and cause or contribute findings for greenhouse gases under Section 202(a) of the Clean Air Act; Proposed Rule.)

is concern that the number of RECs that will flood the market once more large-scale biomass plants go online will decrease the value of the credits, making it more difficult for truly renewable and carbon neutral electricity sources like wind and solar to generate revenue from this source. The value of RECs has already experienced significant fluctuations.

The potential role of biomass energy in Massachusetts

A 2007 Massachusetts Department of Energy Resources (DOER) report on biomass availability[7] states that about 165 megawatts (MW) of biomass power generation are planned for Massachusetts. In contrast, Governor Deval Patrick has called for 2000 MW of wind energy to be developed by 2020, and 250 MW of solar capacity by 2017.[8] If 165 MW of biomass generation were developed, this would constitute about 1.2% of the state's total power generation capacity of 13,557 MW in 2007.[9] A larger amount of biomass generation is actually in the planning stages than just the 165 MW planned in the 2007 report, however. Table 1 includes large biomass-to-power plants that currently exist (Pinetree Power in Westminster), are in the permitting stage (Russell, Greenfield, and Springfield) or have been given news coverage as having a good probability of being built (Pittsfield and two plants in Fitchburg). Like the plants proposed in Russell, Greenfield, and Springfield, the Pittsfield plant has received a $250,000 pre-development loan from the Massachusetts Technology Collaborative's Renewable Energy Trust. The list does not include existing small plants like the combined heat and power plant at Mount Wachusett Community College or the biomass boiler used to heat the administration building at Quabbin, or planned conversions to change boiler systems to biomass fuel, such as that underway at Springfield Technical Community College. It also does not include the proposed conversion of the net 120 MW Somerset coal plant to CDD burning.

[7] Innovative Natural Resource Solutions, 2007. Biomass availability analysis – five counties of Western Massachusetts. Report prepared for the Massachusetts Division of Energy Resources and the Massachusetts Department of Conservation and Recreation.

[8] Patrick sets 2,000-MW wind-power goal. Providence Business News website (http://www.pbn.com/detail/39553.html) posted January 14, 2009.

[9] Summertime electricity generation capacity for the state from Energy Information Administration data. The last year for which capacity information data is available is 2007. To the extent that generation capacity has increased since 2007, the percent of total generation to be provided by biomass diminishes.

Table 1

Status	Plant	Location	Capacity (megawatts)
Existing	Pinetree Power	Westminster	17
In review			
	Russell Biomass	Russell	50
	Palmer Renewable Energy	Springfield	38
	Pioneer Renewable Energy	Greenfield	47
Proposed			
	Tamarack Energy	Pittsfield	30 - 50
	"Munksjo Paper"	Fitchburg	15
	CCI plant at F'burg airport	Fitchburg	15
			Total 212 to 232 MW

Forest cutting impacts of biomass plants

Two of the three plants proposed in western Massachusetts - Russell and Greenfield - would burn primarily forest biomass, while the Palmer plant in Springfield plans to generate approximately 30 MW of its 38 MW by burning construction and demolition debris (CDD). Therefore, the total amount of proposed biomass power generation that would require forest biomass as fuel ranges between 135 MW (the 165 MW in the state report, minus 30 from CDD) and 202 MW (232 minus 30). (The existing Pinetree plant burns forest biomass, "paper cubes", and landfill gas, so it is left out of these calculations, although news reports state that it is currently utilizing about 180,000 tons of wood a year.[10]).

According to the DOER biomass availability report, 13,000 tons of green biomass are required to generate one megawatt of biomass power for one year, assuming a 90% capacity factor.[11] Therefore, the amount of forest biomass wood required to fuel between 135 MW and 202 MW of generation ranges from 1,755,000 to 2,626,000 tons of green biomass per year. The Russell plant alone would require 650,000 tons of wood chips a year, and would burn over a ton of wood a minute. For perspective, a small-scale thermal boiler used to heat a single large building such as the administration building at the Quabbin Reservoir can require 400 – 500 tons of chips during the heating season.

[10] George Barnes, January 24, 2009. New purpose for felled trees. Worcester Telegram.

[11] Page 11 of biomass availability report. The figure of 13,000 tons of green biomass per MW lines up almost exactly with the fuel requirement for the Palmer plant in Springfield when its CDD fuel requirement is converted to green-ton equivalents. However, the Russell Plant, which at 50-MW would require 650,000 tons by the DOER report's fuel estimate, states that it will require only 510,000 tons of fuel per year. The reason for this discrepancy is not known.

The demand for CDD fuel from the Palmer plant in Springfield is projected to be 700 tons per day, or 255,000 tons per year. The Palmer plant would burn another 200 tons per day of forest biomass. The converted Somerset coal plant would burn around 1.1 million tons of CDD a year.[12]

How much new cutting would be required to supply biomass fuel?

It is often claimed that biomass plants are fueled by "forestry residues" from existing forestry operations – tops and branches – that would decompose anyway, emitting greenhouse gases. It is thus argued that utilizing this waste for fuel does not result in any more greenhouse gas emissions that would have occurred in nature. This argument is incorrect in two ways, however. First, decomposition is a slow process which builds soil carbon stocks, whereas combustion instantaneously releases CO2 to the atmosphere, removing biomass carbon and nutrients from the ecosystem. Second, the amount of sawlog timber currently being harvested in the state is nowhere near enough to generate the forestry residues that would be required to fuel the proposed biomass plants, which suggests significant new logging will be required to support the plants. Estimating the number of new acres that would need to be logged requires dividing the total amount of wood needed for biomass fuel by a hypothetical cutting rate. The "Silvicultural and Ecological Considerations" chapter of the DOER biomass availability report[13] states that a harvest rate of 45 green tons per acre is "sustainable", but this number is much higher than average harvesting rates on state and private lands in Massachusetts currently.[14] Table 2 shows the number of acres that would need to be cut each year to supply biomass at two different cutting rates – the 20 tons/acre now more typical of forestry in Massachusetts, and 45 tons/acre. The values are calculated as if *all* wood harvested goes to biomass, and *none* to sawlogs or firewood.

Table 2

MW	tons of wood required	tons cut per acre	total acres cut per year
135	1,755,000	20	87,750
135	1,755,000	45	39,000
202	2,626,000	20	131,300
202	2,626,000	45	58,356

At 20 tons per acre, the three plants currently in the permitting process would require cutting 68,250 acres per year at 20 tons of biomass fuel per acre. For comparison, cutting rates for 2001

[12] To date, Somerset Power has not been forthcoming about the amount of fuel that would be required. The figure presented here is estimated based on fuel consumption by other plants.

[13] Kelty, M.J., D'Amato, A.W., and Barten, P.K. 2007. Silvicultural and ecological considerations of forest biomass harvesting in Massachusetts. Prepared for the Massachusetts Division of Energy Resources and the Massachusetts Department of Conservation and Recreation.

[14] Ibid, 2007.

– 2005 in Massachusetts averaged 1,417 acres on state lands, and 27,561 acres on private lands, for a total of 28,978 acres cut per year.[15] Most of the wood and value extracted from this cutting was from sawlogs and firewood, not biomass, however.

The Middlebury College biomass plant fuel study

Fuel sourcing proposals that actually take into account current demands of sawlog and firewood harvesting are rare. In 2004, Middlebury College in Vermont conducted a wood sustainability study that concluded that their proposed 2 MW combined-heat-and-power gasification plant would need 40,000 acres from which fuel could be reliably sourced, once current demands on the forest were taken into account.[16] Scaled up, such a proposal would require one million acres of land to supply a 50 MW plant. Middlebury College has since initiated a project that would put 1,200 acres of farmland into fast-growing willow production, with the intention of harvesting 400 acres each year to provide fuel when the local chip supply tightens.[17] The 2 MW Middlebury plant uses about 20,000 tons of fuel a year, compared to the 650,000 tons per year that a 50 MW plant like Russell Biomass requires.

Non-renewable fuel sourcing by Russell Biomass

Fuel demand numbers highlight not only the intensity of resource extraction that large-scale biomass plants require, but also that state proposals to build a large amount of generation are unrealistic. The number of acres required to be cut may be reduced, however, if significant amounts of wood are derived from land-clearing, which can yield a larger amount of wood per acre. The air emissions permit for the Russell Biomass plant demonstrates that developers are relying in part on wood from land-clearing for permanent land-use change. The permit states that the fuel supply will consist of:

- Whole Tree Fuel (250,000-350,000 tons per year, from forestry or land-clearing operations)
- Municipal Wood Fuel (100,000-150,000 tons per year of "clean wood" from municipal transfer facilities or private wood yards)
- Stump Grindings (75,000-150,000 tons per year from land-clearing operations)
- Pallet Grindings (25,000-50,000 tons per year of used pallets)

Although combined into a single category, the distinction between wood from forestry operations and wood from land-clearing is an important one. The state's own biomass availability report[18] states that only about 77,000 tons of non-merchantable biomass per year are available from land-clearing operations in the state, a fraction of what a plant needs to operate. The "Losing Ground" report from Massachusetts Audubon[19] provides another estimate of wood from land clearing, stating that almost 8,000 acres of land were cleared per year between 1999 and 2005, of which 5,000 acres were forested. Much of this wood probably went to sawtimber,

[15] Numbers from DCR's 2005 Stakeholder Report, the most recent report available from DCR's website.
[16] Vermont Family Forests Biomass Assessment Team. 2004. Biomass fuel assessment for Middlebury College.
[17] http://www.middlebury.edu/about/pubaff/photos/willow_test.htm
[18] Innovative Natural Resource Solutions, 2007. Biomass availability analysis – five counties of Western Massachusetts. Report prepared for the Massachusetts Division of Energy Resources and the Massachusetts Department of Conservation and Recreation.
[19] http://www.massaudubon.org/losingground/fast_facts.php

which may explain the discrepancy between the two estimates of wood availability. In any case, wood fuel from land cleared from development can not be considered to be "carbon neutral", since that area will never again grow replacement trees to resequester the carbon that was emitted in combustion. In fact, under the new carbon emissions baseline accounting report that was recently produced as a requirement for the Global Warming Solutions Act,[20] the state itself counts land use change emissions as a permanent net loss of carbon from the ecosystem. This suggests that the portion of the electricity generated at the Russell Biomass plant using fuel derived from non-renewable sources like wood from land-clearing should not be eligible to receive renewable energy credits.

Are state lands expected to provide biomass fuel?

The extent of the future role of state lands in providing biomass fuel is still unclear, although state lands are currently providing biomass to the Pinetree plant and plants out of state.[21] The 2007 DOER biomass availability report was explicit that state lands were anticipated to play a large role, stating that "the public forest land base for harvesting is 460,000 acres"[22] of the approximately 844,000 acres considered harvestable. Subsequently, Ecoregional Assessments published by the Executive Office of Energy and Environmental Affairs make it clear that biomass harvesting could be a priority, for instance stating for the Worcester ecoregion that "The region consumes large quantities of energy, and could sustainably produce large quantities of "green certified" biomass." However, while the amount of logging permitted under the Ecoregional Assessments represents a significant increase over levels permitted from 2001 – 2005, the total amount of land logged each year will still be less than was anticipated in the 2007 biomass availability report. This suggests that the actual amount of land available to provide forest biomass in a given year has been greatly overestimated by biomass developers who are relying on numbers provided in the 2007 report. If state lands are now largely off the table, this will naturally increase pressure on private and out-of-state lands as sources of biomass fuel, if large-scale biomass plants are built.

Forester perspectives on biomass harvesting

While some forestry organizations appear to favor biomass development as a way of generating a market for low-value wood, many foresters do not support the development of large-scale biomass in Massachusetts. They are concerned that the removal of tops and branches for fuel after logging operations depletes nutrients that are vital to maintaining forest productivity. Of special concern is calcium, which is also lost from forests because of acid precipitation. None of the state and private entities promoting biomass have addressed the question of nutrient depletion. Calcium is an essential nutrient for cellular function, and its depletion has extremely serious implications for the ability of the land to support a healthy forest.

Many foresters also question biomass economics. At the present time, biomass developers are projecting that they will offer $20 - $30 per ton for chips, of which only about $1 per ton goes to

[20] Massachusetts Department of Environmental Protection. Statewide greenhouse gas emissions level: 1990 baseline and 2020 business as usual projection. Regulatory Authority: MGL Chapter 21N, Section 3. July 1, 2009.
[21] Wood from a recent logging job in Wendell State Forest was chipped and sent to both the Pinetree plant and the biomass plant in Portsmouth, NH.
[22] p. 63, Kelty et al.

the landowner. Where biomass fuel is collected as residuals from ongoing timber improvement operations designed to promote the growth of quality timber for sawlogs, the small market that currently exists for biomass is probably stable. But with the increased demand that would accompany development of large-scale biomass generation, fuel extraction could itself become the primary driver of wood harvesting, disrupting the pace of cutting that currently occurs according to sawtimber improvement needs. Pressure on the wood supply would increase the cost of biomass, and this upward pressure would also increase the cost of firewood to domestic consumers. There is significant concern that upward pressure on fuel costs and availability will induce large-scale biomass operators to turn to construction and demolition debris for fuel, as has occurred in Maine, where the three biomass plants currently operating are now burning 50% CDD, despite having been originally engineered to burn only forest biomass.[23] Small-scale biomass customers in Vermont and New Hampshire are already paying more than $30 a ton for woodchips,[24] thus any assurances by biomass developers that prices will remain low and maintain the current economic projections for the proposed plants in Massachusetts are unrealistic.

Impacts of biomass emissions on for air quality

The western Massachusetts region has been given an "F" by the American Lung Association due to high ground-level ozone, and low grades for particulate matter (PM) pollution levels that are associated with asthma, heart disease, and cancer.[25] Biomass power plants will significantly increase these kinds of pollution in the Pioneer Valley. Biomass burning is a large source of air pollution, emitting nitrogen oxides (NOx), particulate matter (PM), hazardous air pollutants (HAPs), lead, sulfur oxides (SOx), volatile organic compounds (VOCs), carbon monoxide (CO) and carbon dioxide (CO2).

Table 3 shows the combined air emissions if several pollutants from the three proposed biomass plants[26] compared to total emissions in Franklin, Hampshire, and Hampden counties in 2005, the last year for which comprehensive EPA data are available. Emissions from the three proposed plants and the percent increase over 2005 emissions that they would represent are shown for comparison. Metals emissions are not shown in the table, but are discussed below. It is important to note that while we report projected emissions levels from permitting documents submitted by the plant developers to DEP, at least two of the plants (Greenfield and Springfield) underrepresented fuel moisture levels when conducting their fuel moisture modeling. Use of more accurate data would increase pollutant emissions levels. Other serious discrepancies also exist in emissions projections, as well.

[23] Conversation with Paula Clarke, head of the Maine DEP's Solid Waste Division. There are actually around 8 biomass plants that converted over to burning 50% CDD, but not all of them are operating.
[24] Information from Biomass Energy Resource Center, Vermont.
[25] http://www.stateoftheair.org/2009/states/massachusetts/
[26] Information on pollutant emissions taken from Russell Biomass air permit, Pioneer Renewable Energy Air Plan Application, and Palmer Renewable Energy Revised Air Plan Application.

Table 3: Emissions (tons per year) and percent increase over 2005 county-level emissions

Pollutant	Russell	Springfield	Greenfield	Total emissions from plants	Combined emissions from Franklin, Hampshire, and Hampden counties, 2005	Pecent increase over 2005 county baseline
NOx	195.5	133.8	164.3	493.6	4397.1	11%
CO	243.2	156.1	191.0	590.3	2156.7	27%
VOC	32.4	22.3	27.3	82.0	1030.2	8%
SO2	81.0	45.7	68.2	194.9	8893.4	2%
PM	85.4	44.6	53.2	183.2	744.2	25%
HAPs	49.1	22.0	23.7	94.8	750.6	13%
Ammonia	32.4	13.4	16.4			

Nitrogen oxides (NOx)

Along with VOCs, nitrogen oxides are precursors to ground-level ozone formation, a pollutant that causes human respiratory health problems and damages vegetation. In western Massachusetts, the EPA 8-hour health threshold for ozone is exceeded several days each year, and the region is a non-attainment zone for this standard. On these days, ozone levels in western Massachusetts are rated as "unhealthy for sensitive individuals", and the elderly, the young, and those with respiratory conditions are advised to limit activity outdoors.[27] The EPA is currently revisiting the ground-level ozone health standards, stating that "The ozone standards set in 2008 were not as protective as recommended by EPA's panel of science advisors, the Clean Air Scientific Advisory Committee (CASAC)."[28]

Nitrogen oxide emissions from the three plants currently in the permitting process would be at least 494 tons per year, [29] representing an 11% increase over 2005 levels emitted from stationary sources in Hampden, Hampshire, and Franklin counties.[30] In fact, this emissions estimate is likely an underestimate, since emissions modeling for at least two of the plants being conducted at an unrealistically low fuel moisture contents. Interestingly, NOx emissions from the 17 MW Pinetree Power plant in Westminster are were 176 tons per year in 2005, representing the fourth largest source of NOx in Worcester County.

<u>NOx offsets</u>

Industrial sources of NOx are required to purchase offsets at a ratio of 1.26:1, meaning that a total of 620 tons per year of NOx emissions must be retired to meet the obligation imposed by development of the three plants. Although the Secretary of Energy and Environment

[27] See www.airnow.gov for daily updates and health warnings on ground-level ozone and particulate matter levels
[28] Fact sheet: EPA to reconsider ozone pollution standards. Available at http://www.epa.gov/groundlevelozone/pdfs/O3_Reconsideration_FACT%20SHEET_091609.pdf
[29] Overly low fuel moisture estimates were used to model pollutant emissions for the Pioneer plant in Greenfield and the Palmer plant in Springfield. Emissions totals would be higher for that plant if the modeling were done using the correct fuel moisture value (see MEEA comment letter on Greenfield plant for further detail).
[30] Emissions totals for the three counties were obtained from EPA emissions data from 2005.

recommended that offsets for the Russell and Springfield plants be purchased regionally,[31] the air emissions permit for the Russell Biomass plant states that the company is obtaining 113 tons (certified in 2000) and 134 tons per year (certified in 2002) of NOx emission reduction credits from energy generation facilities in the Boston area. Interestingly, the certificate of approval from the Secretary of Energy and Environment on the Russell Biomass Final Environmental Impact Report (FEIR) refers to purchase of offsets, and states: "The Proponent asserts that the operation of the facility will therefore result in a net decrease in regional NOx emissions, and because NOx is a precursor to ozone formation, the project will affect a net decrease in regional ozone concentrations in the air."

Since western Massachusetts is *currently* a "non-attainment" zone for the EPA 8-hour ozone health standard, statements by Russell Biomass that their purchase of these distant and already-realized emission reduction credits will improve air quality are misleading.

Sulfur dioxide

Sulfur dioxide (SO2) exposure causes breathing difficulty for people with asthma, and is also implicated in regional haze and acid rain formation.[32]. Combined emissions from the three proposed plants are stated to be 68.2 tons per year, although this is probably an underestimate due to the problems with the fuel moisture modeling already mentioned. While western Massachusetts is in compliance with the air quality standards for SO2, a new EPA risk assessment of SO2[33] concludes that definite health risks to asthmatics occur at concentrations significantly lower than the current 24-hour health standard for SO2. The document further notes that "over 20 million people in the U.S. have asthma, and therefore, exposure to SO2 likely represents a significant health issue." It is concluded that a new SO2 standard with a 1-hour averaging time would be more protective. If a new standard near the lower end of the proposed range is adopted, western Massachusetts would likely be out of compliance.[34]

Particulate matter (PM)

Particulate matter represents airborne material extremely small in diameter, that is able to penetrate deep into the lungs. It is associated with a variety of health effects. Two size classes are recognized in regulatory schemes: PM10 and PM2.5, with the numeric value referring to the particle size in microns (a micron is one millionth of a meter). There is no current health standard for PM10; EPA's 24-hour and annual exposure standards for PM2.5 are 35 micrograms per cubic meter and 15 micrograms per cubic meter. A recently issued EPA study determined that health impacts of PM are worse than previously thought, finding that higher concentrations of PM are associated with significantly greater risk of death from cardiopulmonary disease, ischemic heart disease (reduction of blood supply to the heart, potentially leading to heart

[31] Secretary's Certificate on the Russell environmental impact report and the Palmer Renewable Energy environmental notification form

[32] http://www.epa.gov/oar/urbanair/so2/hlth1.html

[33] US EPA. Risk and exposure assessment to support the review of the SO2 Primary National Ambient Air Quality Standards. EPA-452/R-09-007, July, 2009.

[34] Page 387 of the EPA risk assessment document discusses a potential new 1-hour standard that might range between 50 – 250 parts per billion (ppb), but is recommended for the lower end of the range. The Palmer Renewable Energy Air Plan Application reports recent 3-hour averages for MA range from the mid-70's to the mid-90's (ppb).

attack), lung cancer, and other causes,[35] A recent EPA risk assessment document acknowledges that the current standards are insufficiently protective and strongly suggests that the agency will be lowering the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ in the relatively near future.[36] If this occurs, western Massachusetts will likely become a "non-attainment" zone for the standards.[37]

The classes of particulate matter classed as "black carbon" have also been recently implicated by recent study as having up to 60% of the climate warming effect of CO2, by both creating "brown clouds" and darkening and thus increasing the heat absorption of snow and ice in polar regions.[38]

Total emissions of PM from the three plants currently in the permitting process would be 183.2 tons per year, representing a 25% increase over current emissions from stationary sources in Hampden, Hampshire, and Franklin counties. Per megawatt, particulate matter emissions from the Russell Plant would be greater than those from the Mount Tom Coal plant, and more than 130 times greater than PM emissions from a gas plant. Recognizing the threat to health that air pollutant emissions from the Russell Biomass plant would represent, the Hampden District Medical Society passed a resolution on October 14, 2009 that the Russell plant "poses an unacceptable threat to the health of the citizens of the Pioneer Valley".

Hazardous Air Pollutants (HAPs)

Hazardous air pollutants (HAPs) is the group name for 187 compounds which are known to have highly harmful health or environmental effects. The list includes metals like chromium, lead, and mercury, as well as compounds like dioxins (products of combustion that are widely considered to be among the most toxic chemicals known), benzene (a constituent of gasoline) and methylene chloride, a widely used solvent. When an emitting source produces more than 10 tons per year of any one HAP, or 25 or more tons of all HAPs, it is considered to be a "major source" under the Federal Clean Air Act, and is subject to greater regulation, including the requirement that the source meet National Emissions Standards for Hazardous Air Pollutants (NESHAPS) and that the source use the Maximum Available Control Technology (MACT).

While the environmental impact review for Russell Biomass acknowledges the plant's potential emission rate of HAPs would be over 49 tons per year, triggering these additional requirements, environmental filings for the Greenfield and Springfield plants state that emission levels of HAPs would be 23.7 and 22 tons per year, respectively, just under the threshold. However, it is extremely likely that both these plants actually will emit more than 25 tons per year of HAPs and should be treated as major sources. The air quality modeling for the Pioneer plant in Greenfield shows that in fact 27 tons of HAPs would be emitted when higher and more realistic fuel moisture levels are used, rather than the low figure presented in the ENF (the air modeling was

[35] Health Effects Institute, 2009. Synopsis of Research Report 140: Extended analysis of the American Cancer Society study of particulate air pollution and mortality. Boston, MA.
[36] U.S. Environmental Protection Agency, 2009. Risk assessment to support the review of the PM primary national ambient air quality standards – external review draft. EPA 450/P-09-006. September, 2009.
[37] 24-hour $PM_{2.5}$ levels in western Massachusetts are already close to 30 ug/m3; if the 24-hour standard is dropped to 30 or 25 ug/m3, the region may be out of attainment.
[38] Ramanathan, V. and G. Carmichael. 2008. Global and regional climate changes due to black carbon. Nature Geoscience 1: 221- 227.

done assuming a fuel moisture content of 40%, which is a physical impossibility. A more realistic estimate is 45% - 50%, given that the plant states it will be burning primarily forest biomass). There are also a number of problems and inconsistencies in the emissions calculations for the Springfield plant, also including overly optimistic assumptions about the fuel moisture levels. Department of Environmental Protection policy is that environmental impact review documents should present "worst case scenarios" so that regulators can act protectively. Both the Pioneer (Greenfield) and Palmer (Springfield) plants appear to have misrepresented their true emissions, which makes regulators' tasks more difficult.

Lead

Lead exposure is linked to a variety of developmental and neurological problems. A recent study concluded that

> "long-term trends in population exposure to gasoline lead were found to be remarkably consistent with subsequent changes in violent crime and unwed pregnancy. Long-term trends in paint and gasoline lead exposure are also strongly associated with subsequent trends in murder rates going back to 1900. The findings on violent crime and unwed pregnancy are consistent with published data describing the relationship between IQ and social behavior. The findings with respect to violent crime are also consistent with studies indicating that children with higher bone lead tend to display more aggressive and delinquent behavior. This analysis demonstrates that widespread exposure to lead is likely to have profound implications for a wide array of socially undesirable outcomes."[39]

Lead paint in construction and demolition debris is common. In their initial filings with the state, Palmer Renewable Energy in Springfield, which will burn 700 tons of CDD a day, applied to be allowed to emit 0.75 lb of lead per hour during peaking periods, and applied for an annual average that was about ten times lower. This suggests that the plant anticipates being in very poor control of its fuel supply. In subsequent filings, DEP lowered the allowable hourly peak emissions rate so that it is now five times the allowable annual average rate. At the same time, the developer increased – on paper - the stated removal efficiency it is claiming for the pollution control system. This means that although nothing about the fuel supply or the sorting procedure has changed, on paper the Springfield plant's lead emissions have dropped significantly from its earlier filings. In fact, the proponent is now claiming an even lower emissions rate for lead than Russell Biomass, even though Russell will primarily burning forest biomass ("clean" wood) and the Springfield plant will be burning CDD with an acknowledged amount of lead paint contamination. There is good reason to think that the Springfield plant will burn as much painted and pressure-treated wood as possible, since the developer has claimed to DEP in writing that the plant will not be "viable" without using this fuel source.[40]

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[39] Quoted from abstract of Nevin, R. 2000. How lead exposure relates to temporal changes in IQ, violent crime, and unwed pregnancy. Environmental Research 83:1-22.

[40] A letter dated February 6, 2007 from Dale Raczynski of Epsilon Associates to DEP, states that previous discussions had "stressed the importance of providing a viable outlet for both "clean" or "A" wood and painted and treated "B" wood… As shown in the preliminary air dispersion modeling set forth in the enclosed protocol, even assuming conservatively high levels of contaminants associated with painted and treated or B wood, the air pollution controls that will be required as BACT for this facility will result in emissions that will meet all of the MassDEP's

Whatever the actual lead emissions at the Springfield plant, they will be higher than the 43 lb emitted by the Mount Tom Coal Plant in 2005, even though the 146 MW Mount Tom plant is almost four times the generation capacity of the 38 MW Springfield plant. Lead emissions from the Russell and Greenfield biomass plants would be 400 lb/yr and 227 lb/yr, respectively, although it should be noted that earlier filings for the Greenfield plant stated a higher number which has subsequently been changed.

Arsenic

Arsenic is highly toxic, and is a principle component of copper-chromium-arsenate (CCA) mixture that was used until recently for pressure-treating lumber. The Springfield biomass facility will rely on visual sorting techniques to remove arsenic-containing pressure-treated wood from the CDD that it burns. However, even DEP's own website admits that pressure-treated wood can be hard to distinguish, stating "You can usually recognize pressure treated wood by its greenish tint, especially on the cut end, and staple-sized slits that line the wood. However, the greenish tint fades with time, and not all pressure treated wood has the slits.[41]" The environmental documents initially filed by the plant stated that arsenic emissions would be up to 33 lb/year and over 98% of DEP's 24-hour Threshold Effects Exposure Limit, the health standard for inhalation. The Massachusetts Department of Environmental Protection has since lowered this allowable threshold to enable the plant to emit 51% of the TEL. However, nothing about the fuel supply, sorting procedures, or emissions controls have changed, only the allowable standard as expressed on paper. No continuous stack emissions monitoring will be conducted – instead, DEP proposes to control emissions of arsenic and other toxics by requiring daily checking of the fuel supply prior to combustion. However, no details are yet available about who will perform this testing, or how often. Given that the plant will be burning 700 tons of CDD fuel a day (28 tractor-trailer loads) it is difficult to imagine a fuel sampling regime that will adequately characterize contamination levels in the fuel. Further, testing for contaminants is expensive, and it can take days to get results back. This means that the plant could easily experience a short-term spike in toxic emissions that might not be detected until days later. As noted for lead, the proponent has indicated that the plant will not be viable if it is not allowed to burn "B" class or painted and pressure-treated wood, thus it seems likely that the incentive exists for the proponent to find ways to "relax" the fuel sampling regime.

Hexavalent Chromium

Chromium is also a constituent of pressure-treated wood, and is highly toxic. EPA's website states: "The respiratory tract is the major target organ for chromium (VI) toxicity, for acute (short-term) and chronic (long-term) inhalation exposures. Shortness of breath, coughing, and wheezing were reported from a case of acute exposure to chromium (VI), while perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, and other respiratory effects have been noted from chronic exposure. Human studies have clearly established that inhaled chromium (VI) is a human carcinogen, resulting in an increased risk of

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stringent ambient air limits. To reiterate what Vic Gatto mention in his letter of January 17, 2007, without the use of C&D wood, including A and B wood, the PRE project will not be viable"

[41] http://www.mass.gov/dep/toxics/ptwoodqa.htm#one

lung cancer. Animal studies have shown hexavalent chromium to cause lung tumors via inhalation exposure."[42]

The Springfield plant is proposing to emit 47 lb of chromium a year, at 41% of DEP's Allowable Ambient Limit (AAL), the yearly exposure health threshold. Emissions from the Greenfield plant would be around 14 lb per year, and the Russell plant would emit around 6 lb per year. Discrepancies of this kind, where the larger (50 MW) plant is projecting lower emissions than the smaller (47 MW) plant, despite similar boiler technologies and fuel streams, cast doubt on the integrity of the pollutant modeling.

Mercury

Mercury is a significant and dangerous contaminant that damages neurological development and other organ functions. It accumulates up food chains, presenting the greatest threat to humans and fish-eating birds like loons. More than half of Massachusetts lakes now have mercury advisories warning that fish are not safe to eat because of their high mercury content. Mercury is transported in the atmosphere but a significant amount from a point source can be deposited nearby, contaminating soils and water bodies. Recognizing the need to reduce mercury levels, the state has proposed new regulations on mercury emissions from coal burning and municipal waste incineration facilities. In 2005, the Mount Tom Coal plant was the largest emitter of mercury in Hampden County, but the new regulations will cap emissions at 0.0075 lb/gigawatt-hour (GWh) so that total emissions will equal 9.6 lb/year, and in 2012, emissions will be capped at 0.0025 lb/GWh (3.2 lb/yr).

In contrast, mercury emissions from the three proposed biomass plants would be 19.56 lb/yr (Springfield: 5.02 lb/year, Greenfield: 6.54 lb/year, Russell: 8 lb/yr), which on a per GWh basis will be significantly times higher than the allowable standard of 0.0025 lb/GWh for coal plants that will go into effect in 2012. As is the case with other hazardous air pollutants, mercury emissions from the Springfield plant appear to have "fallen" about 60% between initial environmental filings by the plant and the latest air emissions plan revision, where DEP placed restrictions on the amount of mercury that could be emitted by the plant. The proponent proposes to meet this new, more stringent standard by reducing, on paper, the amount of mercury found in the fuel. However, nothing about the fuel supply or the sorting regime to obtain "clean" wood has changed. Combined, the current projected mercury emissions from the biomass plants will represent an 7% increase over 2005 emissions from stationary sources in Franklin, Hampshire and Hampden counties. Actual emissions are likely to be higher.

Although mercury enters soils, wetlands, and waterways and is known to persist indefinitely, there is no law in Massachusetts that regulates total lifetime emissions of mercury from any facility, instead regulating only air concentrations. At this time, the only testing for mercury in stack emissions that will occur at the three biomass plants will be one-time stack tests when the facilities start up. At the Palmer facility in Springfield, ongoing fuel sampling prior to combustion could potentially include testing for mercury, but details of this sampling scheme have yet been released.

[42] http://www.epa.gov/ttn/atw/hlthef/chromium.html

Dioxins/Furans

Designated as PCDD/F in the tables of hazardous air pollutants in environmental filings by the proposed plants, dioxins/furans are "persistent, bioaccumulative, and toxic" (PBT) compounds that are created as by-products of chemical manufacturing, and also from combustion. Dioxin/furans are known to affect hormone levels and functions, as well as affecting fetal development, the immune system, and reproduction. They are toxic at levels that already exist in the environment. EPA states: "Because dioxins are widely distributed throughout the environment in low concentrations, are persistent and bioaccumulated, most people have detectable levels of dioxins in their tissues. These levels, in the low parts per trillion, have accumulated over a lifetime and will persist for years, even if no additional exposure were to occur. This background exposure is likely to result in an increased risk of cancer and is uncomfortably close to levels that can cause subtle adverse non-cancer effects in animals and humans."[43]

While it can reasonably be concluded that *any* new emission of dioxins/furans is unhealthy, the three biomass plants will actually be emitting a significant amount of these chemicals. The Palmer plant in Springfield is proposing to emit 0.021 lb of PCDD/F a year, which, as small an amount as it is, is actually 41% of DEP's Allowable Ambient Limit (AAL). As home to Bondi's Island, a large waste combustor that is also a significant source of dioxin/furans, Springfield's exposure to these chemicals is likely quite high. The Greenfield plant is proposing to emit 38% of the AAL. Data are not available for the Russell plant, but it can probably be assumed that the emissions will be similar. The omission of these data from the Russell air permit filings is a clear deficit, since even the two smaller plants will be emitting significant amounts of this very toxic class of contaminants.

Diesel fuel emissions from harvest and transport of wood

Diesel particulate matter is acknowledged as a particularly dangerous air pollutant by the EPA. However, diesel use and associated emissions from forest biomass harvesting are not straightforward to calculate. Fuel use during transport depends on various factors, but assuming that trucks carry about 25 tons each of wood chips, the combined fuel supply of the three biomass plants would require about 65,000 trucks per year, primarily in the HDDV8B class (>60,000 lbs)[44]. Assuming an average round-trip fuel transport distance of 100 miles (probably a low estimate) and assuming that trucks get 6.2 mpg,[45] this adds up to about 6.5 million vehicle miles traveled per year transporting wood fuel to the plants, requiring about 1.05 million gallons of diesel consumption, or close to a gallon of diesel for every ton of wood chip fuel. Using typical CO2, PM, and NOx emissions factors per vehicle mile traveled,[46] this travel would produce 11,752 tons of CO2, 3.23 tons of the highly noxious diesel particulate matter for which

[43] http://www.epa.gov/opptintr/pbt/pubs/dioxins.htm

[44] Russell Biomass was the only biomass plant proposal required to do a trucking emissions study. The study assumes that the majority of trucks used for fuel transport are in the HDDV8B class.

[45] Texas Transportation Institute. 2007. A modal comparison of domestic freight transportation effects on the general public. December 2007; Amended March 2009. Houston, TX. The estimate of 6.2 mpg is presented as typical in modeling performed in this assessment; actual mpg is probably lower.

[46] Ibid, 2007.

EPA states that there is no safe level known[47,48], and 131 tons of NOx, about the same amount of NOx that will be emitted by the Springfield biomass plant. The heavy equipment required for harvesting and processing of woodchips also consumes large amounts of diesel fuel, probably as much again as the transport. Jonathan Clapp, a former manager at the Pinetree biomass plant in Westminster, estimates that total diesel use is about 2 gallons for every ton of wood harvested, including both harvest and transport.[49] None of the diesel emissions from harvesting and transport are acknowledged in any of the air permitting for the proposed biomass plants.

Biomass plant siting and environmental justice considerations

The Massachusetts Environmental Justice (EJ) program is designed to protect the interests of low income and minority residents. The EJ website states: "The Commonwealth's Executive Office of Energy and Environmental Affairs (EEA) established an Environmental Justice Policy to help address the disproportionate share of environmental burdens experienced by lower-income people and communities of color who, at the same time, often lack environmental assets in their neighborhoods. The policy is designed to help ensure their protection from environmental pollution as well as promote community involvement in planning and environmental decision-making to maintain and/or enhance the environmental quality of their neighborhoods."

It is thus interesting to note that three of the four biomass plants that have received pre-development loans from the Massachusetts Technology Collaborative are located in municipalities (Springfield, Greenfield, and Pittsfield) that include "environmental justice communities". The health status of people in these communities can make them particularly susceptible to degradation of air quality by biomass plant emissions. For instance, the Massachusetts Department of Public Health/Bureau of Environmental Health (BEH) determined that asthma rates at three schools located close to the proposed Springfield plant, which will burn CDD, are statistically higher than the state average, and that hospitalization rates for asthma for Springfield as a whole are more than twice the statewide rates. The BEH also determined that the prevalence of children in Springfield with blood lead levels of concern is nearly twice the statewide rate.[50]

Biomass power and the assumption of carbon neutrality

While the statement that biomass energy is carbon neutral is often repeated, even cursory scrutiny shows that this can not be true in any meaningful sense for large-scale biomass plants.

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[47] Lyons, S. 2007. The Massachusetts 2002 diesel particulate matter inventory. Massachusetts Department of Environmental Protection, Boston, MA. September 2007.

[48] Environmental Protection Agency, 2002. Health assessment document for diesel engine exhaust. EPA/600/8-90/057F. May, 2002. "Although the available human evidence shows a lung cancer hazard to be present at occupational exposures that are generally higher than environmental levels, it is reasonable to presume that the hazard extends to environmental exposure levels. … A case for an environmental hazard also is shown by the simple observation that the estimated higher environmental exposure levels are close to, if not overlapping, the lower range of occupational exposures for which lung cancer increases are reported. These considerations taken together support the prudent public health choice of presuming a cancer hazard for DE at environmental levels of exposure."

[49] Statement during a public meeting held in Russell, August 26, 2009.

[50] October 2, 2009 letter from Suzanne Condon, Associate Commissioner Director, Bureau of Environmental Health, to Michaelann Bewsee.

Biomass energy can not be carbon neutral because combustion of the "standing stocks" of carbon represented by trees always puts more carbon dioxide into the air after combustion than was there beforehand, and when harvesting is conducted at the scale required to provide wood to large-scale biomass plants, regrowth of trees to re-establish even the standing stock of carbon that existed prior to cutting takes decades, time that we do not have in the race to lower greenhouse gas emissions. The carbon emitted by cutting and burning is not "made up for" by growth in the forest that remains – the net amount of carbon in the atmosphere will always be more, and the net amount of carbon tied up in biomass will always be less, if the forest is cut and burned than if the forest is left intact. Claims that logging increases the growth rate of the trees remaining after thinning, thus compensating for the biomass removed in the harvest, are overblown. Carbon emissions from soil disturbance and logging slash make logged forests act as carbon sources, not sinks, and it takes decades before a logged forest once again sequesters the carbon that has been removed. This reality is recognized by the fact that the international standard for carbon accounting provided by the Intergovernmental Panel on Climate Change recognizes all logging operations as representing a direct and immediate emission of forest carbon to the atmosphere. Classification of wood fuel derived from land-clearing for development as carbon neutral is particularly incorrect, since land-use change permanently precludes regrowth of the forest.

Carbon dioxide emissions from biomass plants proposed in western Massachusetts

The scale of emissions from the plants proposed in western Massachusetts bear out the impossibility of meaningful carbon neutrality for this energy source. Carbon dioxide emissions from the Russell, Greenfield, and Springfield plants would be about 1,636,000 tons per year, which would represent a 6.4% increase over CO2 emissions from the State's electrical power production sector in 2007.[51] Resulting from massive wood consumption, these "at the smokestack" emissions are about 1.5 times as much per megawatt of power generated as CO2 emissions from coal, and three to four times the emissions from natural gas, and no one – not the state, not the federal government, and no private entity – has demonstrated that this amount of CO2 can be re-sequestered in forest re-growth in a timeframe that's meaningful to addressing climate change, given the decline in forest carbon sequestration capacity that would accompany harvesting on this scale. Such a demonstration is, in fact, impossible. Yet despite the complete lack of any greenhouse gas lifecycle analysis or any analysis of the time required for carbon re-sequestration, current state policy in Massachusetts treats biomass burning as if it produces no greenhouse gases at all.

"Sustainable harvesting" of the biomass fuel supply

Many proponents of biomass power promise to use "sustainably harvested" wood, confusing this idea with carbon neutrality. While the Middlebury College project at least attempted to quantify what was meant by a sustainable supply, there is actually no standard definition of this term used by biomass developers or the state agencies responsible for natural resource management. The narrowest definition of sustainability is that harvesting only takes "net growth" (analogous to interest generated in a bank account). Yet "net growth" is calculated on many different scales, up to the level of all forested acres in the state, so that heavy cutting and even clearcutting (spending down capital) can be compensated by net growth under this scheme, as long as growth is

[51] Emissions data from RGGI accounting state that CO2 emissions were 25,366,733 tons in 2007.

occurring somewhere else. Again, however, there is no accounting of the time it takes for regrowth to occur.

Can biomass energy be carbon neutral, or close to it, when fuel demands are lower, as for small-scale biomass plants? Wood is a low-density fuel, so it takes large amounts to produce a relatively small amount of power, meaning that the amount of wood required to even fuel a few megawatts of power can easily surpass a forest's ability to produce. This can lead to overcutting and a net movement of biomass carbon into the atmosphere. The Middlebury College biomass assessment, referenced above, provides an example – the study concluded that 40,000 acres were reliably needed to provide just 20,000 tons of sustainably harvested fuel for their 2 MW plant, an "area of control" that is very large for the amount of power generated. Recognizing the difficulty of controlling its fuel supply, the college is converting farmland to growing willows for fuel. The deliberate planting and harvesting of a short-rotation fuel supply comes closer to the goal of producing no net increase in atmospheric CO2 than the liquidation of standing native forests, but conversion of farmland to growing energy crops brings its own set of problems.

Viewing forests primarily as a potential source of even sustainably harvested wood does not acknowledge the important role that net annual forest growth is already playing in sequestering carbon dioxide. Northeastern forests are acknowledged as an important global sink for carbon,[52] and wide scale logging that harvested net growth would eliminate that function. In fact, recent data indicate that for forests of the Northeast, removals already exceed forest growth.[53] Seeing forests primarily as energy sources also does not acknowledge the many other roles of undisturbed forests as habitat for plants and animals, as regulators of climate and precipitation, and as filters that provide a steady and unpolluted source of water to rivers and reservoirs. Forestry activities that involve heavy equipment, skid roads, and extraction of timber in amounts sufficient to make biomass harvesting operations profitable degrade all these vital forest functions, something that was acknowledged even in the state's own biomass availability report.

Construction and demolition debris burning and carbon neutrality

Classification of construction and demolition debris (CDD) burning as carbon neutral is especially incorrect, since there is no way to track whether the wood being burned was replaced by new living biomass. Claims that CDD burning has merit because it displaces fossil fuels are misleading, since carbon emissions from CDD are higher than from fossil fuels.[54] Adding to the burden, pollutant and toxics emissions from CDD burning are tens to hundreds of times higher than those from natural gas, the most likely alternative means of power generation. Additionally, the carbon emissions "inherent" in this waste wood (that is, the greenhouse gases that were emitted in the production of finished wood products) mean that the choice to burn these materials

[52] Myeni, R.B., et al. 2001. A large carbon sink in the woody biomass of Northern forests. Proceedings of the National Academy of Sciences. 98:14784-14789.

[53] Damery D. et al. 2009. Developing a sustainable forest biomass industry: Case of the U.S. Northeast. Accepted for publication: Proceedings ECOSUD 2009 Seventh International Conference on Ecosystems and Sustainable Development, 8 – 10 July 2009, Chianciano Terme, Italy

[54] Per MWhr, combustion for electricity generation at a large-scale biomass plant produces about 1.5 times as much CO2 at the smokestack as coal, and 3 – 4 times as much as natural gas. For numbers comparing proposed plants in western Massachusetts to the Mount Tom coal plant, see www.massenvironmentalenergy.org/plantdata

for fuel, rather than re-using them, represents an even greater emission of greenhouse gases than from the equivalent amount of forest biomass, since the production of new materials involves significant investment of energy. While it may be possible to conduct a lifecycle greenhouse gas analysis of forest biomass, taking into account the greenhouse gases produced during harvest, transport and combustion, as well as the amount of carbon sequestration capacity lost by the forest, it is impossible in any practical sense to conduct such an analysis of CDD materials, since their provenance is unknown. Thus, claims of the "carbon neutrality" of CDD waste are especially inaccurate, and plants that burn CDD waste should not be eligible for renewable energy credits.

Biomass plant impacts on water resources

Most large-scale biomass facilities resist installing air-cooling due to high costs and efficiency losses, instead relying on evaporating large amounts of water for cooling. The plants require the most cooling water during hot, dry summer conditions, just when rivers themselves are likely to be most flow-stressed. The Russell plant will require up to 885,000 gallons per day from the Westfield River for cooling, and residual water that is flushed back to the river will be warmer and carry a significant pollutant load. The Russell Biomass permit for the proposed withdrawal was appealed by a 10-citizen group on the basis that it allows water withdrawals and discharges of boiler blowdown back to the river even at historically low flows. Millions of dollars in state funds have been allocated to the reintroduction of the Atlantic Salmon, and the Westfield River has been a particularly important part of that effort. Trout Unlimited supported the appeal of the water withdrawal permit on the basis that it is insufficiently protective of aquatic life in the river.

The Pioneer plant in Greenfield will require up to 880,000 gallons of water for cooling per day, which will come from wastewater treated at the Greenfield treatment plant and about 50,000 gallons per day of groundwater pumped on-site. The wastewater will receive further treatment at the Pioneer facility prior to being used for cooling, but there is no way to eliminate all pollutants. This proposal is thus raising concern about the evaporation of hundreds of thousands of gallons of wastewater that contains unknown amounts of contaminants, including pharmaceuticals that are not eliminated by treatment. This new scenario presents significant permitting challenges at DEP.

One consequence of relying on wastewater for cooling at the Pioneer plant is that there will not be enough flow in the system to provide adequate cooling water at certain times during the summer months. A significant amount of wastewater flow in most systems is inflow from storm sewers and infiltration of groundwater into pipes. When groundwater levels fall during the dry summer months, wastewater flows to the treatment plant are significantly reduced, meaning the Pioneer facility will need to rely on Greenfield's municipal water system to supplement cooling water at the plant and dilute wastewater to levels at which it can be used for cooling. Municipal water will also serve as a backup if there is a failure in water delivery from the wastewater system. The Pioneer plant projects usage of 400,000 gallons a day of municipal water "for a few days at a time" and states that municipal water use "would not exceed an average of 100,000 gallons per day over any three-month period". The figure of 400,000 gallons per days represents about a 22% increase over Greenfield's recent water usage of about 1.8 to 1.97 million gallons per day.

Even when air-cooled, biomass plants require significant amounts of water. The Palmer plant will rely on over 115,000 gallons of treated Springfield water per day for boiler flushing and other functions, even with an air-cooled system. Waste will be discharged to the Springfield treatment system. The Palmer plant had applied to operate as a water-cooled system, but was informed by the Springfield municipal water system that the city's water supply was not adequate to meet this use.