Executive Summary

According to a 2007 report by the Massachusetts Department of Energy Resources, there are plans to promote development of at least 165 megawatts (MW) of large-scale woody biomass power in Massachusetts. In addition to the existing Pinetree plant in Westminster (17 MW), there are three new plants in the permitting process as of summer 2009, representing 135 MW of generation:

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

Russell and Pioneer would burn primarily forest biomass; Palmer would burn about 80% construction and demolition debris (CDD). The combined generation capacity of the three plants would constitute less than 1% of Massachusetts generation capacity.

A new proposal to convert the 120 MW Somerset coal plant a gasification plant for CDD and "recycled paper cubes" is also 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 and the Regional Greenhouse Gas Initiative (RGGI). Biomass power is considered to be "carbon neutral", so it looks like an attractive solution to meeting the region's renewable energy needs. However, upon closer examination, the plants that are being proposed would have significant impacts on forest resources, water resources, and air pollution emissions in western Massachusetts, and they would actually increase CO2 emissions within the time period when they should be reduced to meet RGGI goals. The proposed plants would:

- Require a fuel supply equivalent to at least quadrupling the number of acres of forest cut yearly in Massachusetts
- Increase CO2 emissions over decades, just when there is the greatest need to reduce emissions. The assumption of carbon neutrality, which depends on re-growth of forests, would not be met for decades, if ever, given that forests may not recover at the cutting rates that are proposed.
- Require evaporating close to 2 million gallons of water daily from rivers and drinking water systems to meet cooling 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 22%
- Increase Hazardous Air Pollutants (HAPs) from stationary sources by 13%
- Increase lead emissions by hundreds to thousands of pounds
- Increase mercury emissions from stationary sources by 11%, exceeding emissions from the Mount Tom Coal Plant. Total mercury emissions from the three plants will be more than ten times the amount that will be allowed for coal plants in 2012 under new regulations.
- Degrade forests as providers of climate regulation, habitat, and clean water

What is biomass power?

Biomass power involves the combustion of wood or anything else defined as biomass to generate steam energy (definitions of biomass vary state to state, and can include municipal waste and tires). Large-scale biomass plants range from 15 – 60 megawatts (MW) and operate at about 24% efficiency, unless plants 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 heat to a building or building complex. Some plants utilize gasification technology which combusts biomass at low oxygen levels to generate burnable gas.

As of August 2009, there are three large-scale biomass electricity plants currently in the environmental review/permitting process in Western Massachusetts, none of which would recover waste heat. The three proposed plants will burn primarily green wood from forests, although Palmer Renewable Energy in Springfield will derive about 80% of its power from burning construction and demolition debris (CDD), currently projected to be sourced from Massachusetts and Maine. 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 and "recycled paper cubes". 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 various sources, although some might be generated in-state.

Like the other states operating under the northeastern Regional Greenhouse Gas Initiative (RGGI), Massachusetts is obligated to increase the proportion of its total power generated from "renewable" sources each year. Biomass-generated electrical power is defined as renewable, and it is a much more concentrated source of energy than wind or solar power. Although international greenhouse accounting convention acknowledges that it can take years to decades to "re-sequester" carbon released by burning biomass,[1] biomass energy is treated as if it is "carbon neutral" under current Massachusetts law and regulations, so that greenhouse gas emissions produced by biomass combustion are invisible to the regulatory process.[2] This accounting convention makes large-scale biomass an attractive option on paper for meeting the RGGI goal of achieving a 10% reduction in greenhouse gas emissions from the energy sector by 2018. However, since it is impossible for CO2 released by biomass burning at this scale to be re-grown in time to meet RGGI deadlines, the reductions in emissions in fact do only exist on paper, and not in reality. It is also indisputable that the carbon emissions "inherent" in CDD fuel (that is, the greenhouse gases that were emitted in the production of finished wood products) greatly exceed those from burning forest biomass, meaning that re-sequestration of the equivalent amount of carbon dioxide released by CDD combustion would require re-growing trees in far greater numbers than those originally harvested to produce the wood

[1] 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.

[2] 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.)

What is the potential role of biomass energy in Massachusetts?

A 2007 Massachusetts Department of Energy Resources (DOER) report on biomass availability[3] states that about 165 megawatts (MW) of biomass power generation are planned for Massachusetts. This would constitute about 1.2% of the state's total power generation capacity of 13,557 MW in 2007,[4] an amount of power that could easily be saved with conservation and efficiency measures. A larger amount of biomass generation is currently in the planning stages, 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). 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. It also does not include the proposed conversion of the net 120 MW Somerset coal plant to CDD burning.

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

How much wood would be required by biomass power generation?

Two of the three biomass plants in the planning stage plan to burn forest biomass. The Palmer plant in Springfield, however, will generate approximately 30 of its 38 MW by burning construction and demolition debris (CDD). Therefore, the total amount of 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).

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.[5]

---

3 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.

[4] 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.

[5] 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-

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 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.[6]

Large-scale biomass plants burn over a ton of wood a minute. The Russell plant would require 650,000 tons of wood chips a year. For perspective, a small-scale thermal boiler used to heat a single large building can require 400 – 500 tons of chips during the heating season.

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 converted Somerset coal plant would burn around 1.1 million tons of CDD a year.

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

The amount of sawlog timber currently being harvested in the state is nowhere near enough to generate the "forestry residues" (logging waste) that is often assumed to be the source of biomass fuel. To estimate the number of new acres that would need to be logged, one divides the total amount of wood needed for biomass fuel by the typical cutting rate for Massachusetts forests (20 tons/acre, although much of this wood is cut for high-value sawlogs). The "Silvicultural and Ecological Considerations" chapter of the DOER biomass availability report[7] states that a harvest rate of 45 green tons per acre is "sustainable", but this number is more than double current harvesting rates on state and private lands in Massachusetts. In the interests of keeping calculations as simple as possible, 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 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

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.

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

[7] 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.

At 20 tons per acre, just 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 – 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.[8] Most of the wood and value extracted from this cutting was from sawlogs and firewood, not biomass, however.

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.[9] The 2007 DOER biomass availability report was clear that state lands were anticipated to play a large role, stating that "the public forest land base for harvesting is 460,000 acres"[10] of the approximately 844,000 acres considered harvestable. 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. Increasing reliance on this local, renewable and carbon neutral energy source could enhance forest protection and management and benefit the rural economy while reducing the region's dependence upon imported energy." 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 seemed to have been 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 biomass availability report. If state lands are less available, 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 from a site that are vital to maintaining forest productivity. Of special concern is calcium, which is also lost from forests because of acid precipitation. Some foresters see the harvest rates promoted in the DOER biomass availability report as being unsustainably high, entailing significant costs to forest structure, wildlife habitat, carbon sequestration, and water quality. Careful foresters who regard growing good sawtimber as an art see biomass harvesting on a given piece of forest as a tool that can be used once or maybe twice to remove lower-quality trees, but thereafter should never need to be used again. This limits the number of times a piece of land can be harvested for biomass if good forestry practices favoring high-value timber are being employed.

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 the landowner. Where biomass fuel is collected as residuals from ongoing timber improvement

[8] Numbers from DCR's 2005 Stakeholder Report, the most recent report available from DCR's website.
[9] 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.
[10] p. 63, Kelty et al.

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 three biomass plants currently operating are now burning 50% CDD, despite having been originally engineered to burn only forest biomass.[11] Small-scale biomass customers in Vermont and New Hampshire are already paying more than $30 a ton for woodchips,[12] thus any assurances by biomass developers that prices will remain low and maintain the current economic projections for the proposed plants in Massachusetts are misplaced.

What are the implications of biomass power 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.[13] Biomass power plants will significantly increase exactly these types 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 of nitrogen oxides, particulate matter, and mercury 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 existing emissions that they would represent are shown for comparison. Lead emissions are not shown in the table, but are discussed below.

Table 3

	NOx (tons per year)	**Hazardous Air Pollutants (tons per year)**	**Particulate Matter (tons per year)**	**mercury (lb per year)**
Combined emissions Franklin, Hampshire, Hampden counties 2005	4397	751	744	264
Emissions from proposed Russell, Pioneer, and Palmer plants	492	98	165	28
Percent increase over 2005 emissions from proposed plants	11%	13%	22%	11%

[11] Conversation with Paula Clarke, head of the Maine DEP's Solid Waste Division
[12] Information from Biomass Energy Resource Center, Vermont.
[13] http://www.stateoftheair.org/2009/states/massachusetts/

Nitrogen oxides (NOx)

Nitrogen oxides are precursors to the formation of ground-level ozone, a pollutant that causes human respiratory health problems and damages vegetation. In western Massachusetts, the EPA health threshold for ozone is exceeded several days each year. As of May, 2009, there had already been two days when ozone levels in western Massachusetts were rated as "unhealthy for sensitive individuals", who are defined as the elderly, the young, and those with respiratory conditions. These people are advised to limit outdoor activity on such days.[14]

Nitrogen oxide emissions from the three plants currently in the permitting process would be at least 492 tons per year,[15] representing an 11% increase over levels emitted from stationary sources in Hampden, Hampshire, and Franklin counties (baseline 2005, the last year for which EPA data are available).[16] Emissions from the 17 MW Pinetree Power plant in Westminster are 176 tons per year, representing the fourth largest source of NOx in Worcester County.

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 must be "found" and retired to meet the obligation imposed by development of the three plants. Although the Secretary of Energy and Environment has recommended that offsets for the Russell and Springfield plants be purchased regionally,[17] it seems unlikely that sufficient offsets can be found in the western Massachusetts region, since few large NOx emitters exist in the area.

Particulate matter (PM)

Particulate matter represents airborne material so small in diameter that it penetrates 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, but this may be revised downward in the future in response to emerging science. A recently issued EPA study has 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 attack), lung cancer, and other causes.[18]

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.[19]

---

[14] See www.airnow.gov for daily updates and health warnings on ground-level ozone and particulate matter levels

[15] Overly low fuel moisture estimates were used to model pollutant emissions for the Pioneer plant in Greenfield. 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 details).

[16] Emissions totals for the three counties were obtained from EPA emissions data from 2005.

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

[18] 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.

[19] Ramanathan, V. and G. Carmichael. 2008. Global and regional climate changes due to black carbon. Nature Geoscience 1: 221- 227.

Total emissions of PM from the three plants currently in the permitting process would be 165 tons per year, representing a 22% 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.

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."[20]

While emissions levels will only be finalized once an air permit is issued, Palmer Renewable Energy in Springfield has applied to emit up to 6,570 lb of lead per year , contrasting with 43 lb emitted by the Mount Tom Coal Plant in 2005. Concentrations of lead in the air from the Palmer plant are projected to be over 89% of MassDEP's Threshold Effects Exposure Limit (TEL), which takes into account acute and chronic effects of exposure and is calculated on a 24-hour exposure basis. Lead emissions from the Russell and Pioneer plants would be 316 lb/yr and 262 lb/yr, respectively.

Arsenic

Arsenic is highly toxic, and is found mainly in pressure-treated wood. The Palmer biomass facility will rely on visual sorting techniques to remove arsenic-containing pressure-treated wood from the fuel supply. Arsenic emissions from Palmer facility are projected to be up to 33 lb/year and over 98% of DEP's 24-hour Threshold Effects Exposure Limit. However, no stack emissions monitoring will be conducted. Fuel will instead be spot-checked for arsenic contamination prior to combustion.

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

[20] 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.

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/gigawatthour (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 27.75 lb/yr (Palmer: 13.4 lb/year, Pioneer: 6.54 lb/year, Russell: 7.8 lb/yr), which on a per GWh basis will be almost ten times higher than the allowable standard of 0.0025 lb/GWh for coal plants that will go into effect in 2012. Mercury emissions from the biomass plants will represent an 11% increase over 2005 emissions from stationary sources in Franklin, Hampshire and Hampden counties.

There is no law in Massachusetts that regulates mercury emissions specifically from biomass burners, though emissions from coal and municipal waste burning plants are now regulated. Further, Massachusetts law does not limit the total lifetime emissions of mercury from any facility, instead regulating on 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, fuel will be spot-checked for mercury concentrations by the plant operators.

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 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 Pioneer and Palmer plants state that emission levels of HAPs would be 23.7 and 23.8 tons per year, respectively, just under the threshold. However, a strong case can be made 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 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 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 a number of problems and inconsistencies in the emissions calculations for the Palmer plant, as well. 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 and Palmer plants appear to have misrepresented their true emissions, which makes regulators' tasks more difficult.

Is biomass power carbon neutral?

Carbon dioxide emissions from the Russell, Pioneer, and Palmer plants would be 1,636,000 tons per year, which would represent a 6% increase over CO2 emissions from the State's electrical

power production sector in 2007.[21] Carbon dioxide emissions from biomass are actually 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. Despite these large emissions, current policy treats biomass burning as if it produces no greenhouse gases at all. The supposition of carbon neutrality is based on the assumption that trees can grow back after harvesting, thus burning them produces no net increase in atmospheric carbon dioxide levels. This is a fallacy, however, unless the rate at which carbon is re-grown, versus the rate at which it is cut and burned, is known and carefully controlled. Unfortunately, because wood is such a low-energy fuel, it takes a lot of it to produce a relatively small amount of power, meaning that the amount required to even fuel a few megawatts of power can easily surpass the forest's ability to produce.

Most proponents of biomass power promise to use "sustainably harvested" wood. In fact, at the current time there is no standard definition of this term used by 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, allowing heavy cutting and even clearcutting (spending down capital) to qualify under this definition, as long as growth is occurring somewhere else. Claims that logging increases the growth rate of the trees remaining after thinning, thus compensating for the biomass removed in the harvest, are overblown. In fact, while there can be a small increase in the growth rate of remaining trees, logging depletes standing carbon stocks for years and even decades, depending on the amount of material removed. 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.

Further, 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, and widescale logging that harvested net growth would eliminate that function. 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.

Classification of construction and demolition debris (CDD) burning as carbon neutral is also 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 so much higher than from fossil fuel emissions. Further, 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.

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 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 plants

[21] Emissions data from RGGI accounting.

require the most cooling water during hot, dry summer conditions, just when rivers themselves are likely to be most flow-stressed. The Pioneer plant will require up to 880,000 gallons 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. One consequence of this proposal will be the evaporation of hundreds of thousands of gallons of wastewater that contains unknown amounts of contaminants, a new scenario that presents significant permitting challenges at DEP. The Pioneer plant further projects that it may need to supplement the cooling water supply with up to 400,000 gallons per day of Greenfield's municipal water system.

Even when air-cooled, biomass plants require significant amounts of water. For instance, the Palmer plant will rely on over 115,000 gallons of treated Springfield water per day for boiler flushing and other functions. Waste will be discharged to the Springfield treatment system.