CLEAN ENERGY WHITE PAPER

MASSACHUSETTS PROPOSED FINAL REGULATIONS FOR BIOMASS GENERATING UNITS IN THE RENEWABLE PORTFOLIO STANDARD

Todd Olinsky-Paul, Clean Energy States Alliance

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INTRODUCTION

On April 27, 2012, the Massachusetts Department of Energy Resources (DOER) released proposed final regulations for biomass combustion for purposes of RPS eligibility. This paper summarizes those regulations and includes a brief discussion.[1]

Massachusetts DOER will require several thresholds to be met by biomass-fired generating units in the RPS. Chief among these are separate performance requirements for greenhouse gas (GHG) reductions and for overall plant energy efficiency. The DOER has also established requirements for fuel tracking and carbon accounting, and has issued fuel harvesting guidelines.

DEFINITIONS

The draft regulations include a number of important definitions for biomass harvesting and collection, including:

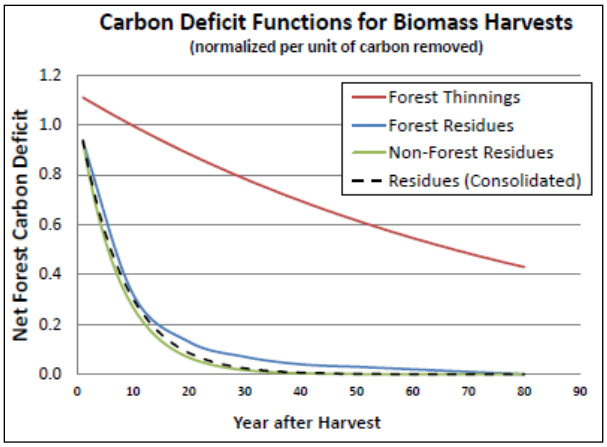
- Forest-Derived Thinnings: unacceptable growing stock, managed thinnings
- Forest-Derived Residues: tops and branches from harvests, invasive species
- Other Residues: forest salvage (pests, storms – government declared event, fire hazard reduction on lands officially designated Fire-adapted Forest Ecosystems), non-forest residues (wood industry, trimmings, land-use change)
- Dedicated Energy Crops: on non-forest, marginal lands
- Construction and demolition material is not allowed.

[1] This summary is based on documents released by the Massachusetts DOER. The draft regulations are available on the DOER website, along with a summary of the regulations, as well as slides and a recording from an informational webinar. See www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/biomass/renewable-portfolio-standard-biomass-policy.html.

GREENHOUSE GAS EMISSIONS REDUCTION REQUIREMENTS

For a biomass-fired electricity generating unit to be eligible for the Massachusetts RPS, DOER will require it to submit an analysis of net lifecycle GHG emissions demonstrating at least a 50% reduction over 20 years, relative to the lifecycle emissions from the combined operation of a new combined-cycle natural gas plant using the most efficient commercially available technology (at the time the submission is made) and, if applicable, the operation of the fossil-fuel-fired thermal energy unit or units being displaced. For the purpose of this analysis, DOER provides two carbon deficit curves for woody biomass fuel: one for residue materials, which quickly repay their carbon debt (termed "carbon deficit" in the regulations); and another for forest thinnings, which will not lead to a sufficient repayment of their carbon debt within the state's 20-year time horizon (see Figure 1). Generation units must therefore balance their ratio of residues to thinnings in order to meet the overall carbon reduction threshold.

Figure 1



Source: Massachusetts DOER, Proposed Final Regulation 225 CMR 14.00, 2012

OVERALL EFFICIENCY REQUIREMENTS

In addition to the GHG emissions reduction described above, DOER requires that biomass plants must achieve 60% overall energy efficiency to qualify for full REC credit. Those achieving 50% efficiency will qualify for ½ REC credit, and this increases linearly to the full credit at 60%. Biomass plants employing advanced technology earn ½ REC value if they achieve 40% efficiency improvement, increasing linearly to a full REC value at 60% (units using advanced energy conversion, emissions reduction, or fuel processing technologies may apply for this designation).

The overall efficiency of biomass-fired generating units is calculated on a quarterly basis and is defined by the following equation:

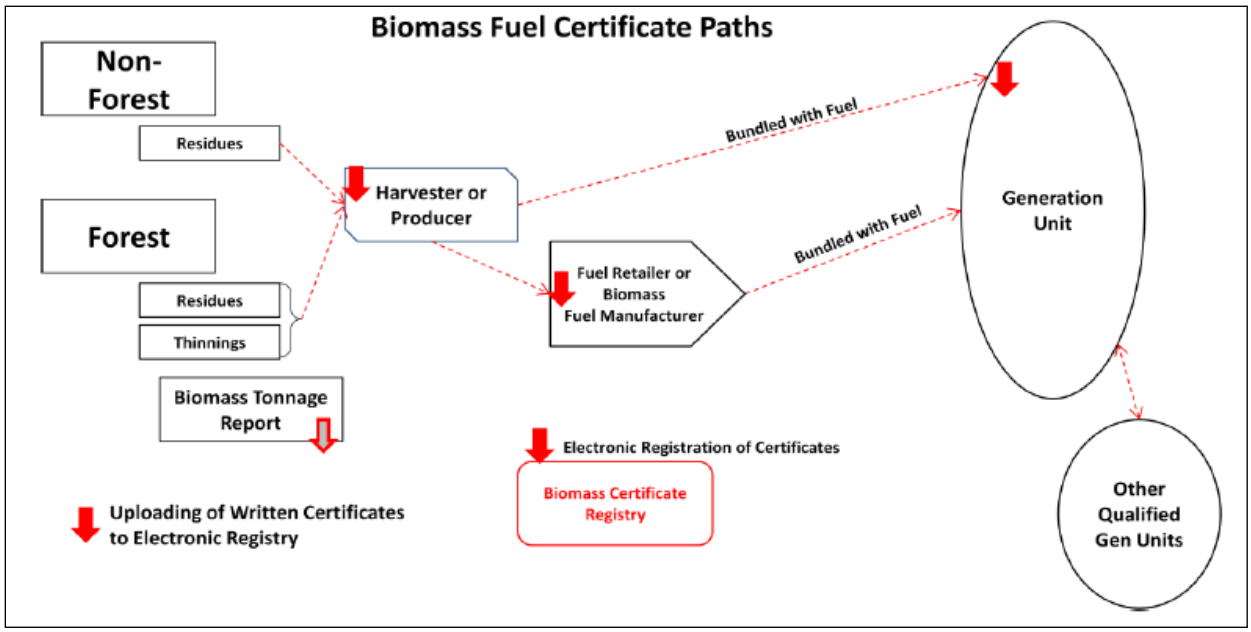
> *Overall Efficiency = [Electric generation not utilized behind-the-meter + Electric generation utilized behind-the-meter divided by 0.92 (line losses) + Useful Thermal Energy + Merchantable Bio-Products] divided by Biomass Input Heat Content*

Full guidelines for the overall efficiency and GHG analyses have been prepared by DOER for a unit to demonstrate its ability to meet these requirements as part of the Statement of Qualification (SQ) application.

FUEL TRACKING AND CARBON ACCOUNTING

The regulations establish an electronic Biomass Certificate Registry that will enable fuel tracking and carbon accounting through the use of biomass fuel certificates. These certificates will be characterized by fuel source (residues or thinnings) and will remain bundled with the biomass fuel (or re-bundled if the fuel is co-mingled). The regulations also establish an advisory panel, which will assess the tracking and verification of biomass certificates, impacts on the fuel market, and the accounting of GHG emissions. The biomass certificate pathway is shown in Figure 2:

Figure 2



Source: Massachusetts DOER, Proposed Final Regulation 225 CMR 14.00, 2012

HARVESTING GUIDELINES

For purposes of biomass harvesting, soils are categorized as either “good” or “poor,” as identified on USDA’s NRCS soil maps (poor soils are those that are shallow-to-bedrock, dysic histosols (organic wetland soils, low nutrients, low pH), or dry, nutrient-poor sandy soils). Allowable biomass removals depend on soil characterization, but in no case may more than 30% of the total weight of harvest be removed as eligible fuel, as shown in Figure 3 on the following page.

Figure 3

Soil Restrictions (based on USDA NRCS Criteria)	Good Soils	Poor Soils
Percent of Tops and Branches of Forest Products Harvested that must be retained on site	25%	100%
Percent of Weight of Forest Products Harvested that may be removed (as Residues or Thinnings) as Eligible Biomass Woody Fuel	30%	30%

Source: Massachusetts DOER, Proposed Final Regulation 225 CMR 14.00, 2012

For harvest sites of 50 acres and less, allowable biomass removal may be based on the averaging of soil conditions present on the site.

Additional forest thinning may be done for ecological or forest management purposes, but such additional thinning material will not qualify as eligible biomass fuel. Biomass removal is not allowed from old growth forest stands and steep slopes, and in all cases the following types of material must be retained in the forest:

- All naturally down woody material
- Forest litter, forest floor, roots and stumps
- Live cavity trees, den trees, and other live decaying trees or snags must be retained in sufficient quantities to maintain important habitat.

COMPLIANCE FILINGS AND UNDER-COMPLIANCE

Each January, all biomass generation units must file an annual compliance report on the previous year's fuel consumption (residues and thinning) and overall efficiency. Fuel consumption will be demonstrated by the biomass fuel certificates in the unit's account on the Biomass Certificate Registry. Any variances from the proposed fuel supply plan for that year must be explained, and the compliance report must include a GHG emissions analysis based on the DOER guideline, actual fuel use and overall efficiency.

If a unit falls short of compliance with its required 20-year GHG reduction threshold, an under-compliance fee of $0.50/REC will be assessed for each percentage point below the prescribed reduction threshold, for all RECs generated in the previous compliance year which are settled in the Massachusetts RPS Class I program. The unit will also be placed on probation, and its SQ noticed for termination in five years. Probation and the notice of termination will be cancelled if the unit demonstrates that the under-compliance has been made up with a net over-compliance during the probationary period, of if the unit meets compliance for any three years during the probationary period. DOER will impose increasingly rigorous requirements during the probationary period, requiring that the unit demonstrates that an increasing percentage of its fuel use certificates have been procured under contract from biomass residue sources.

Under-compliance fees will be collected by the Massachusetts Clean Energy Center and used as directed by DOER to provide support for industry investments across the supply chain for forest biomass residue materials, or for activities, such as tree planting, that increase carbon sequestration in biomass.

TIMELINE AND TREATMENT OF PREVIOUSLY QUALIFIED UNITS

All existing biomass units will maintain qualification through 2012, after which they must provide DOER a fuel supply plan and use eligible biomass woody fuel, as demonstrated through ownership of biomass fuel certificates, in order to maintain qualification through 2014. Beginning in 2016, all units must meet the overall efficiency and GHG reduction thresholds described above, and all other provisions of the regulation.

PROGRAM VERIFICATION AND IMPACT ASSESSMENT

An advisory panel will meet no less than twice a year and provide findings and recommendations to DOER regarding confidence in verification and enforcement of eligible fuel standards and the tracking of biomass fuel certificates. Forest impacts will be assessed every five years by DOER, in coordination with DCR; this assessment will also survey aggregate fuel use by sources, and evaluate appropriateness and accuracy of GHG accounting methodologies.

PUBLIC COMMENT PERIOD

DOER Is soliciting public comments on the proposed final regulations and the accompanying guidelines through June 18th, 2012.

DISCUSSION

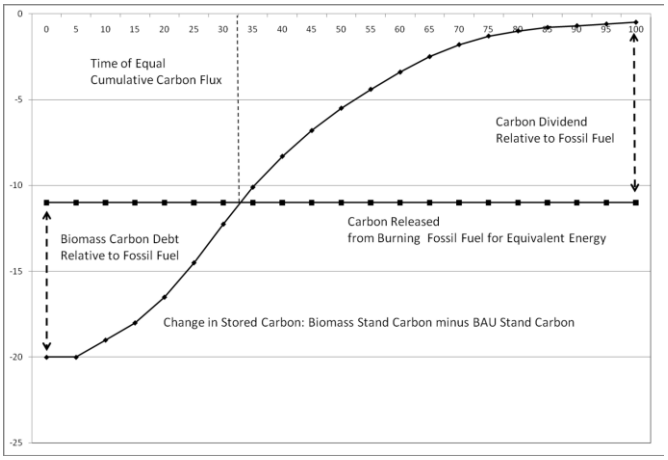
Under the proposed DOER regulations, qualified biomass units are subject to two main performance requirements; first, that they achieve a 50% GHG emissions reduction over 20 years, relative to a state-of-the-art combined-cycle natural gas plant and any displaced thermal plants; and second, that they achieve a relatively high threshold of overall energy efficiency of 60% to receive full REC credits, and 50% to receive ½ REC credits (or 40% in the case of advanced technology facilities).

The emissions reduction requirement is based on DOER's carbon cycle accounting methodology, which embraces the stand-level approach used in the Manomet Biomass Sustainability and Carbon Policy study of 2010. The Manomet study was commissioned by DOER to examine the life-cycle GHG impacts of harvesting and burning forest biomass. The basic foundation of the Manomet study is a series of previous studies, first reported in 2008, that challenged the notion that replacing fossil fuels for transportation with dedicated energy crops would immediately result in reduced carbon emissions.[2] These studies showed that initial biomass harvesting results in a "carbon debt," due to carbon released

[2] See Joseph Fargione, *et al.,* Land Clearing and the Biofuel Carbon Debt, *Science* 319, 1235 (2008); and Timothy Searchinger, *et al.,* Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change, *Science* 29, 1238 (2008).

from the biomass when it is combusted; this carbon debt is "paid off" over time by the substitution of subsequently-grown biomass for fossil fuels, until a break-even point, sometimes termed "carbon neutrality," is reached. Thereafter, continued use of biomass to replace fossil fuels results in a "carbon dividend," as further emissions of long-cycle carbon from the combustion of coal, natural gas or oil are replaced with emissions of short-cycle carbon from the combustion of biomass, which is recaptured from the atmosphere by the next generation of growing plants. The time from initial biomass harvest to carbon neutrality depends on a number of variables, including the lifecycle of the biomass, the biomass-to-energy conversion technology employed, the type of fossil fuel and electricity generation technology being replaced, and the type of ecosystem or farm management employed. This basic carbon debt/carbon dividend idea is captured in Figure 4:

Figure 4



Source: Manomet Center for Conservations Sciences, Biomass Sustainability and Carbon Policy Study

The Manomet Center concluded that using wood to replace coal in electricity generation in Massachusetts would result in a carbon debt of 21 years, while replacing natural gas-fired generation with biomass would result in a carbon debt of more than 90 years. The study also addressed the issue of sustainable forestry management, and recommended methods for ensuring that stands harvested for electricity production be sustainably maintained.

The conclusions of the Manomet Study have been controversial, and a number of critiques have been published. Prominent among the critiques is the argument that the Manomet study's debt-then-dividend model is based on the life cycle of a single tree stand rather than on a "landscape" or larger forested area, and that it does not take into account the carbon already sequestered when harvesting begins. Competing analyses claim that in a sustainably managed forest system, the overall amount of carbon sequestered in living biomass can continue to increase while mature trees are selectively harvested for electricity generation. This alternative view suggests that there need be no initial carbon debt, and that the overall forest system can retain a carbon-neutral or even carbon-positive growth curve from day one. These competing conclusions are arrived at because their authors used different assumptions about forest life cycles and management, and drew their life-cycle boundaries differently.[3]

[3] The original Manomet study, several critiques of it, and Manomet's responses to the critiques are available on the Manomet Center website, at http://www.manomet.org/manomet-study-woody-biomass-energy.

The 60% energy efficiency requirement virtually guarantees that only combined-heat-and-power (CHP) units will be able to qualify for full RECs. To put this number into context, coal-fired power plant efficiency (without heat capture) averaged only 35.1% worldwide in 2007, according to the International Energy Agency. Experiments with extremely high temperature steam processes indicate that within the next decade, a new state-of-the-art coal plant might achieve efficiencies of around 45%; however, efficiency penalties are expected if plants are equipped with carbon capture equipment. Given that wood has a higher moisture content and a lower energy density than coal, the requirement that wood burning units achieve much greater efficiency than coal plants amounts to a *de facto* exclusion of biomass-fired units that do not capture significant amounts of waste heat. CHP plants in the US tend to operate at the building or campus level, because a large heat load is needed to allow the plant to operate at optimum efficiency; such plants are likely to make only small contributions to the Massachusetts RPS.

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ABOUT CLEAN ENERGY STATES ALLIANCE

Clean Energy States Alliance (CESA) is a national nonprofit coalition of state clean energy funds and other sub-federal programs working together to develop and promote clean energy technologies and markets. CESA provides information sharing, technical assistance services and a collaborative network for its members by coordinating multi-state efforts, leveraging funding for projects and research, and assisting members with program development and evaluation.

Many states across the U.S. have established public benefit funds to support the deployment and commercialization of clean energy technologies. Eighteen states make up the core base of CESA membership. Though these clean energy funds, states are investing hundreds of millions of public dollars each year to stimulate the technology innovation process, moving wind, solar, biomass, and hydrogen technologies out of the laboratory and toward wider use and application in business, residential, agricultural, community and industrial settings. State clean energy funds are pioneering new investment models and demonstrating leadership to create practical clean energy solutions for the 21st century.

Founded in 2003, CESA, managed by Clean Energy Group, is headquartered in Montpelier, Vermont, with staff based in Washington, D.C. Visit us at www.cleanenergystates.org.