NATURAL CAPITAL INITIATIVE AT MANOMET **REPORT**

Biomass Sustainability and Carbon Policy Study

Chapter 1

Prepared for:

Commonwealth of Massachusetts
Department of Energy Resources
100 Cambridge Street
Boston, Massachusetts 02114

Prepared by:

Manomet Center for Conservation Sciences
81 Stage Point Road
P.O. Box 1770
Manomet, Massachusetts 02345
Phone: (508) 224-6521

Contributors:

Thomas Walker, Resource Economist (Study Team Leader)
Dr. Peter Cardellichio, Forest Economist
Andrea Colnes, Biomass Energy Resource Center
Dr. John Gunn, Manomet Center for Conservation Sciences
Brian Kittler, Pinchot Institute for Conservation
Bob Perschel, Forest Guild
Christopher Recchia, Biomass Energy Resource Center
Dr. David Saah, Spatial Informatics Group

Contact Information for Report:

Manomet Center for Conservation Sciences
Natural Capital Initiative
14 Maine Street, Suite 305
Brunswick, Maine 04011
Phone: 207-721-9040
jgunn@manomet.org

CHAPTER 1

INTERNATIONAL AND U.S. FOREST BIOMASS ENERGY POLICIES

1.1 OVERVIEW

International and U.S. domestic forest biomass energy policies form a critical backdrop to the analyses presented in this report. The purpose of this introductory chapter is to provide a general understanding of (1) the development of policies that have driven the growth of the biomass energy sector; (2) the key policy instruments that have been relied upon to promote this development; and (3) a summary of recent discussions about the greenhouse gas (GHG) implications of forest biomass energy.

The chapter is organized into two major sections. The first reviews international biomass energy policie—focusing on the historical development of these policies, discussing the policy instruments in place that promote biomass development, and summarizing recent concerns about the impact on GHG of emissions from biomass energy facilities. The second section provides a more detailed review of U.S. energy policies affecting forest biomass both at the federal and state levels, with a particular focus on policies in Massachusetts.

1.2 INTERNATIONAL FOREST BIOMASS ENERGY POLICIES

1.2.1 Historical Context

The late 20th century development of forest biomass energy facilities originated from energy security concerns triggered by the 1973–1974 oil crisis. The International Energy Agency (IEA) was founded at this time primarily to address the security issue.

> *Energy Security can be described as "the uninterrupted physical availability at a price which is affordable, while respecting environment concerns." The need to increase "energy security" was the main objective underpinning the establishment of the IEA. With particular emphasis on oil security, the Agency was created in order to establish effective mechanisms for the implementation of policies on a broad spectrum of energy issues: mechanisms that were workable and reliable, and could be implemented on a co-operative basis (International Energy Agency, 2010).*

Although IEA's original founding agreements did not explicitly address forest biomass, the agency created IEA Bioenergy in 1978 with:

> *…the aim of improving cooperation and information exchange between countries that have national programmes in bioenergy research, development and deployment (IEA Bioenergy, 2010).*

Our review of available documents suggests that prior to IEA Bioenergy's 1998–2002 Strategic Plan (IEA Bioenergy, NA), the greenhouse gas implications of forest biomass combustion were not a primary area of research for the organization (IEA Bioenergy, 1995). Moreover, recent IEA policies have continued to reflect the view that biomass combustion is "close to carbon neutral in most instances" (International Energy Agency, 2007).

In fact, from a climate change perspective, the desirability of biomass energy appears to have been the prevailing wisdom of international bioenergy policies over most of the past ten or fifteen years. These policies have generally equated burning of biomass from renewable sources with "climate friendly" outcomes. The presumption has been that as long as the harvested areas grow back as forests, the emitted CO_2 emissions will be recaptured in the growing trees, resulting in lower net CO_2 emissions over time across the entire energy generation sector. For example, in a 2000 study of forestry and land use, the Intergovernmental Panel on Climate Change (IPCC), the lead international organization charged with assessing impacts of greenhouse gas emissions, stated that:

> *Biomass energy can be used to avoid greenhouse gas emissions from fossil fuels by providing equivalent energy services: electricity, transportation fuels, and heat. The avoided fossil fuel CO_2 emissions of a biomass energy system are equal to the fossil fuels substituted by biomass energy services minus the fossil fuels used in the biomass energy system. These quantities can be estimated with a full fuel-cycle analysis of the system. The net effect on fossil fuel CO_2 emissions is evident as a reduction in fossil fuel consumption (IPCC, 2000).*

In its most recent 2007 assessment, IPCC noted that:

> *In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit.*
>
> *For the purpose of this discussion, the options available to reduce emissions by sources and/or to increase removals by sinks in the forest sector are grouped into four general categories (1)…(4) increasing the use of biomass-derived energy to substitute fossil fuels (IPCC, 2007).*

European Union policies also promote the use of forest biomass energy, as embodied in the EU's 2006 Forest Action Plan:

> *The EU has adopted an ambitious energy and climate policy which aims by 2020 to reduce energy consumption by 20%, with a similar cut in CO_2 emissions, while raising the share of renewables in the EU's energy mix to 20%.*
>
> *More than half of the EU's renewable energy already comes from biomass, 80% of which is wood biomass. Wood can play an important role as a provider of biomass energy to offset fossil fuel emissions, and as an environmentally friendly material. There has recently been higher demand for wood from the energy sector in addition to*

rising demand from the established wood-processing industries. Many experts consider that significantly more wood could be mobilised from EU forests than is currently the case. However, the cost at which this can be done is the key factor (EU, 2006).

In approving the Forest Action Plan, the Commission of European Communities identified a variety of key actions, including:

Key action 4: Promote the use of forest biomass for energy generation

Using wood as an energy source can help to mitigate climate change by substituting fossil fuel, improving energy self-sufficiency, enhancing security of supply and providing job opportunities in rural areas.

The Standing Forestry Committee will support the implementation of the Biomass Action Plan (Commission of European Communities, 2005) in particular concerning the development of markets for pellets and chips and information to forest owners about the opportunities of energy feedstock production.

The Commission will facilitate investigation and dissemination of experience on mobilisation of low-value timber, small-sized wood and wood residues for energy production. The Member States will assess the availability of wood and wood residues and the feasibility of using them for energy production at national and regional levels, in order to consider further actions in support of the use of wood for energy generation. The 7th Research Framework Programme and the IEE-CIP provide the necessary possibilities to facilitate such activities.

The Commission will continue to support research and development of technologies for the production of heat, cooling, electricity and fuels from forest resources in the energy theme of the 7th Research Framework Programme's cooperation specific programme, and to encourage the development of the biofuel technology platform and support the implementation of its research agenda through the 7th Research Framework Programme (Commission of European Communities, 2006).

1.2.2 Policy Instruments

Energy policies for forest biomass are embedded in a broader system of policies promoting the development of renewable energy sources. These policies are typically implemented through incentive schemes such as feed-in tariffs that guarantee favorable purchase prices for renewables and through Renewable Portfolio Standards (RPS) requiring that renewable sources constitute a certain minimum percentage of energy generation. A 2009 status report from the Renewable Energy Policy Network for the 21st Century (REN21) provides summary data characterizing the renewable energy policies of countries around the globe. According to REN21:

By early 2009, policy targets existed in at least 73 countries, and at least 64 countries had policies to promote renewable power generation, including 45 countries and 18 states/provinces/territories with feed-in tariffs (many of these recently updated). The number of countries/states/provinces with renewable portfolio standards increased to 49. Policy targets for renewable energy were added, supplemented, revised, or clarified in a large number of countries in 2008 (Renewable Energy Policy Network for the 21st Century, 2009).[4]

By allowing projects to qualify for feed-in tariffs and be counted towards RPS goals, designation of forest biomass as a renewable energy source has been an important driver of biomass energy project development. The REN21 status report indicates that by the end of 2008, 52 GW of biomass power capacity existed worldwide, about evenly split between developed and developing countries. The European Union and United States accounted for 15 GW and 8 GW of this capacity, respectively. About 2 GW of this total were added in 2008, an annual increase of approximately 4 percent.

Within the broad context of biomass energy policies, individual countries have emphasized different policy instruments. A variety of researchers have conducted assessments of country-specific impacts of biomass policies—for an excellent summary see (Junginger, 2007). Faaij (2006) points out that:

All EU-15 countries implemented policies for supporting bioenergy. These include the deployment of compensation schemes, tax deduction (in some cases specifically aimed at biofuels), feed-in tariffs, tax incentives, energy tax exemption, bidding schemes, CO_2-tax and quota. Precise targets on the national level differ strongly however and are hard to compare because of differences in definitions and fuels in or excluded (such as MSW and peat).The same is true for the level of (financial) support provided through the various programs and instruments. The different countries clearly have chosen very different approaches in developing and deploying various bio-energy options. Partly this is caused by the natural conditions (type of resources and crops, climate) and the structure of the energy system, and also by the specific political priorities linked to the agricultural and forestry sectors in those countries.

A general conclusion of these studies is that higher rates of biomass energy development are typically a function not of any single factor but instead result from the combined effects of a variety of policy instruments, in the context of a country's existing mix of energy sources and the degree of development of its forestry sector (Kautto, 2007; Junginger, 2007). For example, Sweden is one of the European countries that have most rapidly adopted biomass energy systems. Two key factors have been identified as

[4] For an extensive list of countries and their policies, see Table 2, pages 23–24, www.ren21.net/pdf/RE2007_Global_Status_Report.pdf, and pages 17–18 of www.ren21.net/pdf/RE_GSR_2009_Update.pdf

the basis for this growth. First is the presence of a large and well-developed forest products sector. Second, the design of Sweden's tax system has strongly encouraged biomass development through a range of mutually reinforcing policies.

Overall it appears that taxation has been a very effective policy instrument in increasing biomass utilisation in Sweden throughout the 1990's. This has particularly been the case in the heat sector, but, following market liberalisation, significant increases in the electricity sector have also been noted. It should be noted in this respect that the Swedish tax regime is long established and comprises multiple layers of VAT, energy and CO_2 taxes, increasing the effectiveness of tax increases. There is also a complex and frequently modified system of allocating rebates to certain industries that has enabled the tax to be augmented as required to encourage biomass use at the expense of fossil fuels, while maintaining competitive industrial advantage (Cooper & Thornley, 2007).

On the other hand, Faaij (2006) points out that France's focus on biofuels and heat is primarily a function of excess capacity in its nuclear electricity production sector, making electrical generation from biomass unattractive.

The government policies of non-European countries also could dramatically increase biomass energy generation. For example, China has established a variety of policies goals that will promote biomass energy development (Roberts, 2010). By 2020, China is proposing to build 24 GW of biomass power capacity, equivalent to more than eight 25 MW plants per month over the next decade, although Roberts notes this is overly ambitious and likely to be downgraded to 10 GW. Although most of China's biomass appears to be based on agricultural wastes, plans do include increasing wood pellet production from two million tons per year in 2010 to 50 million tons per year by 2020 and developing 13.3 million hectares of forests to produce biomass feedstock. According to Roberts (2010), China has accounted for 23 percent of recent worldwide investment in biomass energy (compared with Europe's 44 percent share). Policies in large forested countries like Canada are also aimed at promoting biomass energy development, although Roberts notes that Canada has been slow in developing its bioenergy resources and that most "meaningful" biomass policies are being put in place at the provincial level, for example Ontario's feed-in tariffs and British Columbia's carbon tax.

Overall, growth of the biomass sector internationally could have important implications for the U.S. and Massachusetts. In Britain, two 300 MW biomass power plants are currently in the planning stages. These plants are projected to consume six million green tons of wood chips annually, purchased from around the globe, with New England identified as a possible source of woodchips (MGT Power, 2010). Given the potential for such increased international trade in biomass, Massachusetts forests could become suppliers of biomass regardless of whether any biomass plants are actually built in the state.

1.2.3 Sustainability Concerns

Although mainstream policies continue to promote biomass as a renewable and carbon friendly fuel, the international policy framework is beginning to move require more detailed assessments of the carbon implications of bioenergy development. This more sophisticated approach to understanding the greenhouse gas implications of climate policy dates from the 1990s when researchers began building formal models to explore the impacts of biomass combustion on greenhouse gas levels, for example studies by Marland and Schlamadinger (1995).[5] Work along these lines became a prominent feature of research conducted IEA Bioenergy Task 38, which is focused directly on the climate change implications of biomass combustion for energy. Researchers contributing to Task 38 have pointed out the difficulty of generalizing about the climate benefits of biomass combustion. This view was expressed in a December 2009 status report from IEA Bioenergy issued to coincide with the Copenhagen conference on climate change. This report provided a clearly articulated summary of the current, and in our view state-of-the-art, thinking on the impacts of forest biomass combustion on greenhouse gases.

> *Ranking of land use options based on their contribution to climate change mitigation is also complicated by the fact that the performance of the different options is site-specific and is determined by many parameters. Among the more critical parameters are:*
>
> - *Biomass productivity and the efficiency with which the harvested material is used—high productivity and efficiency in use favour the bioenergy option. Low productivity land may be better used for carbon sinks, given that this can be accomplished without displacing land users to other areas where their activities lead to indirect CO_2 emissions. Local acceptance is also a prerequisite for the long-term integrity of sink projects.*
> - *The fossil fuel system to be displaced—the GHG emissions reduction is for instance higher when bioenergy replaces coal that is used with low efficiency and lower when it replaces efficient natural gas-based electricity or gasoline/diesel for transport.*
> - *The initial state of the land converted to carbon sinks or bioenergy plantations (and of land elsewhere possibly impacted indirectly)—conversion of land with large carbon stocks in soils and vegetation can completely negate the climate benefit of the sink/bioenergy establishment.*
> - *The relative attractiveness of the bioenergy and carbon sink options is also dependent on the timescale that is used for the evaluation. A short timeframe (a few*

[5] For a more complete list of Task 38 background papers from the 1990s, see www.ieabioenergy-task38.org/publications/backgroundpapers/backgroundpapers.htm#marland1

decades) tends to favour the sink option, while a longer timeframe favours the bioenergy option. The reason is that the accumulation of carbon in forests and soils cannot continue endlessly—the forest eventually matures and reaches a steady state condition. This is also the case for soils. In contrast, bioenergy can be produced repeatedly and continue to deliver greenhouse gas emissions reduction by substituting fossil fuels.

The bioenergy and carbon sink options obviously differ in their influence on the energy and transport systems. Bioenergy promotion induces system changes as the use of biofuels for heat, power, and transport increases. In contrast, the carbon sink option reduces the need for system change in relation to a given climate target since it has the same effect as shifting to a less ambitious climate target. The lock-in character of the sink option is one disadvantage: mature forests that have ceased to serve as carbon sinks can in principle be managed in a conventional manner to produce timber and other forest products, offering a relatively low GHG reduction per hectare. Alternatively, they could be converted to higher yielding energy plantations (or to food production) but this would involve the release of at least part of the carbon store created. On the other hand, carbon sinks can be viewed as a way to buy time for the advancement of climate-friendly energy technologies other than bioenergy. Thus, from an energy and transport systems transformation perspective, the merits of the two options are highly dependent on expectations about other energy technologies (IEA Bioenergy, 2009).

Growing concerns about greenhouse gas impacts of forest biomass policies also surfaced recently in journal articles by Johnson (2008) and by Searchinger, et al. (2009). The Searchinger article, appearing in Science and titled "Fixing a Critical Climate Accounting Error," points out that rules for applying the Kyoto Protocol and national cap-and-trade laws contain a major flaw in that the CO_2 emissions from biomass energy are not properly taken into account because they embody the implicit assumption that all biomass energy is carbon neutral. Consistent with the recent IEA report discussed above, Searchinger's critique states:

The potential of bioenergy to reduce greenhouse gas emissions inherently depends on the source of the biomass and its net land-use effects. Replacing fossil fuels with bioenergy does not by itself reduce carbon emissions, because CO_2 released by tailpipes and smokestacks is roughly the same per unit of energy regardless of the source. Bioenergy therefore reduces greenhouse gases only if the growth and harvesting of the biomass for energy capture carbon above and beyond what would be sequestered anyway and thereby offset emissions from energy use. This additional carbon may result from land management changes that increase plant uptake or from the use of biomass that would otherwise decompose rapidly.

In on-line supporting material for the Science article, Searchinger et al. note that:

Use of forests for electricity on additional carbon: *Roughly a quarter of anthropogenic emissions of carbon dioxide are removed from the atmosphere by the terrestrial carbon sink, of which the re-growth of forests cut in previous decades plays a major role. Any gain in carbon stored in regenerating forests contributes to the sink, so activities that keep otherwise regenerating forests to constant levels of carbon reduces that sink relative to what would have occurred without those activities.*

The net effect of harvesting wood for bioenergy is complicated and requires more analysis. Each ton of wood consumed in a boiler instead of coal does not significantly alter combustion emissions. However, some of the wood in standing timber is typically not utilized and is left to decay in the forest or nearby, causing additional emissions. Much of the carbon in roots will also decompose. Replanting may accelerate release of carbon from forest soils. As the forest regenerates following cutting, it may sequester carbon faster or slower than would have occurred in the absence of the harvesting, depending on the previous forest's age, site quality and forest type. Over long periods, the carbon stocks of the forests with and without the harvest for biofuels may be equal. For this reason, how different emissions are valued over time plays an important role in estimating the net carbon effects of harvesting wood for use as a bioenergy.

In Europe, policies towards biomass may be beginning to reflect this more complex view of potential greenhouse gas impacts. A 2009 EU policy directive recognizes the need to demonstrate the sustainability of biomass energy, and specifies that the European Commission complete such a study.

Section 75: The requirements for a sustainability scheme for energy uses of biomass, other than bioliquids and biofuels, should be analysed by the Commission in 2009, taking into account the need for biomass resources to be managed in a sustainable manner (European Parliament and Council, 2009).

However, the results of this recently completed study of biomass sustainability, take as a starting point the presumption of biomass carbon neutrality—adopting the long-term view that CO_2 emissions from combusted biomass eventually will be recaptured as long as the forests are regenerated. In this context, the report goes on to discuss a variety of recommended policy options including ones to ensure that all biomass is sourced from certified sustainable supplies. To the extent that this new report becomes the basis for future EU policies, such policies would appear to adopt a very long-term view of the relevant timeframe for biomass policies, one that does not place great emphasis on the potential for shorter term increases in CO_2 flux that likely result from forest biomass energy generation.

At the broader international level, the IPCC is also in the processing of preparing a new report on renewable energy that is expected to be published in 2011. Initial indications are that this report will provide more detailed considerations of the carbon issue for forest biomass.

1.3 U.S. FEDERAL FOREST BIOMASS ENERGY POLICIES

1.3.1 Most Significant Federal Programs & Incentives for Biomass Energy

Federal incentives for renewable energy (including forest biomass) have taken many forms over the past four decades. The focus of most of these programs has been on encouraging renewable electricity generation and, more recently, production of renewable transportation fuels, such as ethanol. The third area of energy use—thermal applications for heat, cooling and industrial process heat—has not been a focus of federal energy programs until very recently. A summary of the full scope of existing federal programs and incentives related to the development of biomass energy facilities is included as Appendix 1-A to this report.

Federal policy initially encouraged renewable electricity generation by requiring utilities to purchase electricity from renewable energy generators at a fixed cost through the Public Utility Regulatory Policy Act (PURPA). More recently, federal policy has shifted towards encouraging renewable energy through tax incentives and direct grants—with the primary focus on renewable transportation fuels and renewable electricity generation.

The thrust of current federal investment in renewable energy is summarized in a recent report by the Environmental Law Institute (Environmental Law Institute, 2009). From 2002 through 2008 the U.S. Government spent approximately $29 billion on renewable energy subsidies (compared to $72 billion spent on fossil fuels). Of this $29 billion, most was dedicated to transportation fuels or electricity generation through a combination of tax programs and direct grants and loans.

- **Transportation fuels** via corn-based ethanol production received more than half of the total subsidies ($16 billion), primarily through the Volumetric Ethanol Excise Tax Credit Program (VEETC) ($11 billion) and the corn-based ethanol grant program ($5 billion).
- **Renewable electricity generation** projects received approximately $6 billion in subsidies during this seven-year period, principally through the Production Tax Credit ($5 billion), the Investment Tax Credit ($250 million), the Modified Accelerated Cost Recovery System ($200 million), and the Clean Renewable Energy Bond program ($85 million).
- **Thermal energy** as a sector received no significant subsidies.

Within the electric power sector biomass facilities are eligible for funding under these four primary renewable electricity generation incentives (the Production Tax Credit, Investment Tax Credit, Modified Accelerated Cost Recovery System, and Clean Renewable Energy Bond program); however they have received a relatively small share of the total funding. The U.S. Energy Information Administration (EIA) estimates that in fiscal year 2007, open-loop biomass facilities received approximately $4 million in tax credits under the production tax credit program, compared to approximately $600 million for wind facilities. Funding for combined heat and power or purely thermal facilities is also negligible compared to expenditures on other renewable resources (EIA, 2008). And many of the biomass-specific grant programs have total annual allocations in the $1 to $5 million range, with individual projects often capped in the $50,000 to $500,000 range.

The primary federal subsidy or incentive to biomass electric power production is the Renewable Electricity Production Tax Credit which provides $0.011 per kWh or approximately $10 per MWh.[6] As discussed more fully below, while smaller in value than state Renewable Energy Credits (REC's), which currently average between $20–$35 per MWh, the PTC does provide a significant and stable incentive for the development of biomass power over time. The American Recovery and Reinvestment Act of 2009 allows taxpayers eligible for the federal renewable electricity production tax credit (PTC) to take the federal business energy investment tax credit (ITC) or to receive a grant from the U.S. Treasury Department instead of taking the PTC for new installations for up to 30% of capital costs following the beginning of commercial production. The new law also allows taxpayers eligible for the business ITC to receive a grant from the U.S. Treasury instead of taking the business ITC for new installations. Grants are available to eligible properties placed in service in 2009 or 2010, or if completed by 2013.

Within federal subsidies specific to biomass energy, there is an even greater emphasis on transportation fuels, a very limited focus on biomass power, and no historic public policy support for biomass thermal applications.

In addition to the federal Production Tax Credit, the Biomass Crop Assistance Program (BCAP) has provided significant subsidies over the past year to the biomass supply sector. However, it is considered unlikely that the current high level of subsidies will continue. Created in the 2008 Farm Bill, BCAP (sec. 9011) is an innovative program intended to support establishment and production of eligible crops for conversion to bio-energy, and to assist agricultural and forest landowners with collection, harvest, storage, and transportation (CHST) of these eligible materials to approved biomass conversion facilities (BCF).

[6] The federal renewable electricity production tax credit (PTC) is a per-kilowatt-hour tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. Originally enacted in 1992, the PTC has been renewed and expanded numerous times, most recently by H.R. 1424 (Div. B, Sec. 101 & 102) in October 2008 and again by H.R. 1 (Div. B, Section 1101 & 1102) in February 2009. Efforts to again renew the PTC are currently underway in the US Congress.

The program pays for up to 75% of establishment costs of new energy crops. In addition, farmers participating in a selected BCAP project area surrounding a qualifying BCF can collect five years of payments (15 years for woody biomass) for the establishment of new energy crops. An additional matching payment of up to $45/ton (on a $1 to $1 basis) to assist with collection, harvest, storage and transportation (CHST) of an eligible material to a BCF will also be available for a period of two years.

The launch of this new program has resulted in a substantial new subsidy for the existing wood market with significant market impact. Large numbers of existing biomass conversion facilities (led by lumber, pellet and paper mills currently burning wood for their own energy use without a federal subsidy) submitted applications to USDA to be approved as qualifying facilities. Consequently, funds obligated (though not yet spent) for BCAP through the end of March 2010 soared to over $500 million, more than seven times BCAP's estimated budget of $70 million in the 2008 Farm Bill. The USDA now estimates BCAP costs at $2.1 billion on CHST from 2010 through 2013.

USDA has allocated $2.1 million to Massachusetts for BCAP payments and $500,000 has been dispersed to date. Despite broad outreach (11 public meetings and other efforts), BCAP enrollment has been limited in the state, probably due to the limited array of biomass facilities. In Massachusetts, there are two qualifying biomass conversion facilities (BCF): Pinetree Power (17 MW electric generation facility) and LaSalle Florists, a very small greenhouse operation (USDA, 2010). Pinetree Power has about 20–25 suppliers that are approved eligible material owners (EMO). Based on interviews with procurement personnel at the Pinetree facility, the long-term impact of BCAP is unknown at this point. Overall, it is perceived to have created instability in the supply sector, potentially cutting costs for the electric power industry, but increasing costs for other competing industries that are not enrolled in the program. In Pinetree's view, it also might encourage overcutting in response to the short-term subsidy to suppliers. The lack of forest management requirements for the program was also noted. [7]

Based on interviews with Cousineau Forest Products, a leader in the wood brokerage industry for pulp, chips and biomass supplies across New England and the east, approximately 50% of the BCAP subsidy is being passed onto qualifying facilities from suppliers in the form of lower prices paid for fuel. Consequently, as currently structured, the BCAP program is significantly lowering fuel costs for the biomass power sector. Where landholdings are small, such as in Massachusetts, these savings generally accrue to loggers and the biomass consumers. In areas with larger landholdings, more of these savings go to landowners.

The Commodity Credit Corporation (CCC) has issued a draft rule to implement BCAP specifying the requirements for eligible participants, biomass conversion facilities, and biomass crops and materials. Public comment on the draft rule closed on April 9, 2010. Comments on the rule address a diversity of issues ranging from overall support for the continuation of the program to concern that the initial focus on CHST payments has resulted in a substantial new subsidy for the existing woody-biomass market, creating market distortions and instability in the supply sector, cutting costs for some users (e.g. biomass power plants) and increasing costs for other competing industries (OSB manufacturers and other users of bark and chips). In addition, some comments have raised the issue of that the absence of forest management requirements in BCAP could encourage overcutting in response to the short term subsidy to suppliers. Others have spoken to the need to focus BCAP on directing more resources towards the establishment and production of new energy crops, so the program can fulfill its purpose of expanding the amount of biomass available for alternative energy.

1.3.2 Environmental Protection Agency Position on Biomass Energy and Carbon Accounting [8]

As determined by the Environmental Protection Agency in their final rule on Mandatory Reporting of Greenhouse Gases, electric generation and thermal facilities are not required to count emissions associated with biomass combustion when determining whether they meet or exceed the threshold for reporting (emission of 25,000 metric tons per year for all aggregated sources at a facility). But if the threshold is exceeded, facilities are required to separately report emissions associated with the biomass combustion. Thus, facilities that rely primarily on biomass fuels are not be required to report under the rule (EPA, 2009).

This approach is consistent with IPCC Guidelines for National Greenhouse Gas Inventories, which require the separate reporting of CO_2 emissions from biomass combustion, and the approach taken in the U.S. Inventory of Greenhouse Gas Emissions and Sinks. Separate reporting of emissions from biomass combustion is also consistent with some State and regional GHG programs, such as California's mandatory GHG reporting program, the Western Climate Initiative, and The Climate Registry, all of which require reporting of biogenic emissions from stationary fuel combustion sources. While this reporting requirement does not imply whether emissions from combustion of biomass will or will not be regulated in the future, the data collected will improve EPA's understanding of the extent of biomass combustion and the sectors of the economy where biomass fuels are used. It will also allow EPA to improve methods for quantifying emissions through testing of biomass fuels.

7 Pinetree Power information based on interviews with Tim Haley who prepared their BCAP application and Jamie Damman (M.S.) forester and wood buyer for North Country Procurement, consultant to Pinetree Power.

8 Much of this section is drawn directly and/or quoted verbatim from the EPA's Response to Public Comments Volume No.: 1 Selection of Source Categories to Report and Level of Reporting, September 2009

This rule is based on the EPA's basic premise that burning biomass for energy is considered to be carbon-neutral when considered in the context of natural carbon cycling:

> *Although the burning of biomass also produces carbon dioxide, the primary greenhouse gas, it is considered to be part of the natural carbon cycle of the earth. The plants take up carbon dioxide from the air while they are growing and then return it to the air when they are burned, thereby causing no net increase. Biomass contains much less sulfur and nitrogen than coal; therefore, when biomass is co-fired with coal, sulfur dioxide and nitrogen oxides emissions are lower than when coal is burned alone. When the role of renewable biomass in the carbon cycle is considered, the carbon dioxide emissions that result from co-firing biomass with coal are lower than those from burning coal alone (EPA, 2010).*

Regarding consideration of life-cycle emissions, the EPA has stated that preparation of a complete life cycle analysis is beyond the scope of this rule:

> *With respect to emissions and sequestration from agricultural sources and other land uses, the rule does not require reporting of emissions or sequestration associated with deforestation, carbon storage in living biomass or harvested wood products. These categories were excluded because currently available, practical reporting methods to calculate facility-level emissions for these sources can be difficult to implement and can yield uncertain results. Currently, there are no direct GHG emission measurement methods available except for research methods that are very expensive and require sophisticated equipment (EPA, 2009).*

Regarding biomass-derived transportation fuels, the Energy Independence and Security Act of 2007 (EISA) (P.L. 110-140) required EPA to establish a rule for mandatory lifecycle GHG reduction thresholds for various renewable liquid transportation fuel production pathways, including those using wood as a feedstock. Each qualifying renewable fuel must demonstrate that net GHG emissions are less than the lifecycle GHG emissions of the 2005 baseline average for the fossil fuel that it replaces. For non-agricultural feedstocks, renewable fuel producers can comply with the regulation by: (1) collecting and maintaining appropriate records from their feedstock suppliers in order to demonstrate that feedstocks are produced in a manner that is consistent with the renewable biomass requirements outlined in the ruling, or (2) fund an independent third party to conduct annual renewable biomass quality-assurance audits based on an a framework approved by EPA.

1.3.3 Pending Federal Climate and Energy Legislation

Pending federal climate and energy legislation continues to be in flux, with an uncertain future and significantly evolving content. Overall, these bills focus primarily on the production of renewable electricity and transportation fuels rather than production of thermal energy. In all of the various versions of these bills, energy produced from biomass is considered to be renewable and carbon neutral and generally excluded from proposed caps on carbon emissions and related proposals for carbon emission allowances. There is continuing debate about the definition of biomass from qualifying sources and various proposals to provide safeguards for natural resources on public and/or private lands. This debate also includes consideration of sustainability requirements or guidelines for biomass to qualify as a renewable fuel. There is concern that aggressive targets for increasing the use of biomass for production of renewable electricity and transportation fuels from the current Renewable Fuels Standard, a proposed Renewable Electricity Standard and a limit on carbon emissions would outstrip the capacity of our nation's forests to provide an economically and ecologically sustainable supply. To ensure sustainable harvesting levels and accurate accounting of carbon emissions and re-sequestration, there is discussion and debate about including emissions from renewable biomass energy under proposed carbon caps based on full lifecycle accounting. At this point, however, it is unclear what direction will emerge in this developing legislation.

1.4 MASSACHUSETTS FOREST BIOMASS ENERGY POLICIES

Massachusetts has implemented policies to increase the use of biomass to meet energy needs in the electricity sector, the transportation sector, and the building heating sector, although as is the case at the federal level, state policies have been focused primarily on using biomass to replace fossil fuels in the electricity and transportation sectors. Combined with the state's regulatory structure for implementing the Regional Greenhouse Gas Initiative (RGGI) (which sets an emissions cap on fossil fuel electrical generation systems of 25 megawatts or greater), this has created significant incentives driving the state towards greater reliance on biomass electric generation capacity. A recent exception to this trend is the Massachusetts Green Communities Act of 2008, which established new Renewable and Alternative Energy Portfolio Standards (RPS and APS) that allow eligible CHP units to receive credits for useful thermal energy. This program promotes the installation and effective operation of new CHP units for residential, commercial, industrial, and institutional applications. Overall, the bill significantly reforms the state's energy policy, and makes large new commitments to electric and natural gas energy efficiency programs, renewables, and clean fossil fuels like combined heat and power (Environment Northeast, 2008).

Massachusetts has two regulatory programs that directly impact the incentives for developing biomass-fueled electricity in the state. The first is the Massachusetts Renewable Portfolio Standard (RPS), which is administered by the Department of Energy Resources (DOER), and the second is the implementation of the state's membership in the Regional Greenhouse Gas Initiative (RGGI), which is administered by the Department of Environmental Protection (DEP).

1.4.1 Massachusetts Renewable Portfolio Standard

The Massachusetts RPS program currently mandates that all retail electricity suppliers must include minimum percentages of RPS Class I Renewable Generation, RPS Class II Renewable Generation, and RPS Class II Waste Energy in the retail electricity they sell to consumers. For 2010, the Class I requirement is 5%, the Class II Renewable requirement is 3.6%, and the Class II Waste requirement is 3.5%. The definition of "eligible biomass fuel" under the RPS program is:

> *Fuel sources including brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips, shavings, slash and other clean wood that are not mixed with other unsorted solid wastes; by-products or waste from animals or agricultural crops; food or vegetative material; energy crops; algae; organic refuse-derived fuel; anaerobic digester gas and other biogases that are derived from such resources; and neat Eligible Liquid Biofuel that is derived from such fuel sources.*

It is notable that this definition contains no "sustainability" requirement. The RGGI definition, by contrast, does contain such a requirement, though the criteria for sustainability in that definition are not fleshed out at this time. This definition also includes liquid biofuels, which are expressly excluded from the definition of "eligible biomass" for purposes of the Massachusetts RGGI program.

Biomass facilities may qualify as RPS Class I or Class II generation units as long as they are classified as "low-emission, advanced biomass Power Conversion Technologies using an Eligible Biomass Fuel." Both the Class I and Class II RPS regulations also allow generators that co-fire to qualify as RPS Renewable Generation as long as certain requirements are met. This provision in the RPS program is analogous to the biomass exemption from carbon dioxide emissions accounting in the RGGI program.

In 2008, the Massachusetts Green Communities Act established new Renewable and Alternative Energy Portfolio Standards (RPS and APS) allowing Combined Heat and Power facilities to be included as an eligible technology, provided the thermal output of a CHP unit is used in Massachusetts. APS eligible CHP units receive credits for the useful thermal energy of a CHP unit delivered to Massachusetts end-uses, subject to the formula included in the regulations. The DOER rules issued for this program will, for the first time in the Commonwealth, promote the installation of new CHP units for residential, commercial, industrial, and institutional applications.

A central component of the Massachusetts RPS program is the issuance of Renewable Energy Credits (REC's) for biomass-fueled electric power generation, providing a significant incentive and market driver for large-scale biomass electric power generation. While the market price for REC's varies significantly based on state RPS requirements, the available pool of qualifying renewable energy sources, and overall demand for electricity, they are a very significant factor in the economics of biomass power generation and a significant factor in negotiating Power Purchase Agreements. The current market price for REC's is between \$20–\$40 per MWh and the average monthly price for electricity in the ISO New England region from March 2003—February 2010 is \$62/MWh (ISO New England, 2010). At these rates (which have been even higher in past years with REC's bringing up to \$50/MWh) REC's are clearly a major, though variable, factor in a biomass power plant's return on investment.

1.4.2 Massachusetts RGGI Implementation

As a member of the Regional Greenhouse Gas Initiative (RGGI), Massachusetts has agreed with ten other states to cap carbon dioxide emissions from large (i.e. > 25 MWe) fossil fuel-fired electric power plants in the ten-state region, and to lower this cap over time. Each individual state has adopted regulations to create allowances corresponding to their share of the cap, and to implement accounting, trading, and monitoring regulations necessary to control emissions. Any allowance can be used for compliance with any state's RGGI regulation. The RGGI Model Rule provides a template on which all state regulations are based.

The RGGI Model Rule includes three provisions related to the combustion of biomass fuels. The first exempts facilities whose fuel composition is 95% or greater biomass from the program. The second allows projects that achieve emissions reductions by switching to certain biomass-derived fuels for heating to apply to create offset allowances. The third applies to regulated facilities that co-fire biomass fuels with fossil fuels, or switch completely from fossil to biomass fuel. In such cases, emissions that result from the combustion of "eligible biomass" fuels are not counted toward compliance obligations. Massachusetts' RGGI regulation includes all three of these provisions, but no power plant or offset project in the state has yet applied to take advantage of the co-firing or offset provisions. The definition of below is from Massachusetts' RGGI regulation:

> ***Eligible biomass.*** *Eligible biomass includes sustainably harvested woody and herbaceous fuel sources that are available on a renewable or recurring basis (excluding old-growth timber), including dedicated energy crops and trees, agricultural food and feed crop residues, aquatic plants, unadulterated wood and wood residues, animal wastes, other clean organic wastes not mixed with other solid wastes, and biogas derived from such fuel sources. Liquid biofuels do not qualify as eligible biomass. Sustainably harvested shall be determined by the Department [of Environmental Protection].*

In addition to the complete exemption from the RGGI system for generators whose fuel composition is 95 percent or greater biomass, the RGGI Model Rule and all participating states except for Maine and Vermont provide partial exemptions for facilities that co-fire with smaller percentages of biomass. This partial exemption provides that any carbon dioxide emissions attributable to "eligible biomass" may be deducted from a facility's total carbon dioxide emissions when calculating whether the facility's emissions are within its carbon-allowance budget.

Regarding the impact of the Regional Greenhouse Gas Initiative (RGGI) as an incentive for biomass electric power generation, since RGGI defines biomass power as carbon neutral and exempt from participation in the carbon allowance program and categorically excludes biomass power from allowable offsets qualifying for carbon allowances, biomass energy receives no direct incentives through the carbon allowance auction program central to RGGI implementation. It might be incentivized, however, through state investments in clean energy from auction revenues allocated to consumer benefit and renewable energy and efficiency programs. In Massachusetts, these revenues are allocated to five uses, as follows, based on the recently passed 2008 Green Communities Act: promotion of energy efficiency and demand response (minimum of 80% of revenue); reimbursement of municipalities in which tax receipts decrease due to RGGI (limited to 3 years); green communities (not to exceed $10 million per year); zero-interest loans to some municipalities for efficiency projects; and, state administration of the cap and trade program (Green Communities Act, 2008).

In terms of the impact of the RGGI program on the development of biomass generating facilities, should auction prices rise sufficiently, they could provide an incentive for generating facilities to switch to biomass as a power source, or for the construction of new biomass-fired power plants. However, at current allowance prices of approximately $2 per ton of carbon dioxide, there is insufficient price pressure to incentivize such a shift at this time (RGGI, Inc, 2010).

A summary of the range of statutory and regulatory provisions that directly address biomass in Massachusetts, with an emphasis on biomass policy within the electricity sector, is included in Appendix 1-A to this report.

1.5 BIOMASS ENERGY POLICIES IN OTHER STATES

Based on a review of eleven states' policies regarding biomass (Arizona, California, Connecticut, Maryland, Minnesota, Missouri, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin), the thrust of state policies promoting biomass and/or biofuels is focused on electric generation and less so on transportation and thermal. All surveyed states have numerous policies, programs and/or incentives to promote electric generation from renewable sources of energy, including biomass. A few states have policies to support the use of biomass/biofuels for transportation (California, Minnesota, Oregon, Pennsylvania, Washington, and Wisconsin) and/or for thermal production (Arizona, Connecticut, Missouri, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin).

Typically, states include biomass as one of a number of sources of renewable energy in a variety of policies and programs aimed at increasing electric generation from renewable energy such as renewable portfolio standards. Other common state policies supportive of biomass electric generation are net metering programs; public benefits funds; other grant and/or loan programs; power purchasing programs at the state and/or local level; and a variety of tax incentives. [9]

States with large sources of biomass supply—Minnesota, Missouri, Oregon, Washington and Wisconsin—also tend to have biomass-specific policies or programs in addition to general programs such as renewable portfolio standards. These states are also likely to have biomass working groups or a biomass program (Connecticut, Minnesota, Oregon, Pennsylvania, and Vermont). Some have produced biomass reports, including woody biomass supply assessments. (Arizona, California, Minnesota, Oregon, Vermont, Washington, and Wisconsin). These reports typically focus more on biomass promotion and less on sustainability, and some discuss the linkage between biomass utilization and climate change. Finally, some states have produced woody biomass harvesting guidelines that focus on best management practices for harvesting woody biomass in an ecologically sensitive and sustainable manner (Minnesota, Missouri, Pennsylvania, and Wisconsin). All such harvesting guidelines are voluntary, guidance only.

1.6 OVERALL STATE AND FEDERAL POLICY DRIVERS FOR BIOMASS POWER IN MASSACHUSETTS

While conclusive data on the cumulative amounts and impacts of the suite of state and federal policies relevant to biomass power are not available, interviews with plant managers and experts in the field of electric power regulation and development[10] and analyses of federal subsidies indicate that, generally, the most important federal subsidy is the Production Tax credit ($10 per MWh) and most important state incentives are Renewable Portfolio Standards and the related sale of Renewable Energy Credits (currently $25–$35 per MWh). While the value of a REC is higher, the price varies significantly in the marketplace with the cycling of RPS requirements, emergence of new technologies, construction of new renewable energy facilities, the state of the economy and demand for electric power. While less valuable at only $10/MWh, the federal PTC is a more stable source of income for biomass plants over time.

Overall, the economics of individual biomass power plants are determined by the Power Purchase Agreement (PPA), which defines a long-term contract for the purchase of power from a generating facility to utilities or other buyers in the electric power market. PPA's include some or all of the power produced by the generating facility and can also include some or all of the REC's held by a facility into long term contracts. Overall, banks and other investors need confidence in a credible investment stream stemming from a contract including an adequate price (for power

9 For a description of the range of tax incentive programs, see the public policy program appendix to this report

10 Synapse Energy Economics, Cambridge, Massachusetts; Innovative Natural Resource Solutions, Portland, ME; Mc Neill Generating Station, Burlington VT; Schiller Station, Portsmouth, NH; Ryegate Power Station, East Ryegate, VT.

and possibly REC's) over a sufficiently long period of time to satisfy the debt service for the facility. It's worth noting that only one new biomass power plant has been built in the region since the advent of REC's (Schiller) and that RECs are considered to be an important feature in their financial picture.

After the Power Purchase Agreement, the second largest cost variable involved in the finances of a biomass power plant is fuel supply and pricing. For example, the Ryegate plant in Vermont and Schiller plant in New Hampshire spend between 60% and 70% of their operating costs on fuel purchases and generally, costs in excess of $30–$35 per ton are considered the maximums if biomass power is to remain competitive with other fossil fuel capacity.[11] Given the relative importance of fuel purchases on operating costs, BCAP payments could play a significant role in incentivizing power plants over other non-energy biomass uses in Massachusetts if a continued high level of subsidy to suppliers of biomass to qualifying electric generation facilities lowers fuel supply costs for the power sector. However, given current Congressional review of the BCAP program and the USDA rulemaking process, it is considered unlikely that current levels of subsidies will continue.

Regarding relative incentives for the construction and location of biomass power plants in Massachusetts versus other New England states, it does not appear that there are significant subsidies or incentives in existing public policy that make Massachusetts more or less likely to attract new biomass power plant proposals. While Massachusetts does have a strong market for REC's due to their well-established and aggressive RPS program, this does not provide any particular incentive for building qualifying plants in Massachusetts versus surrounding states. Furthermore, Massachusetts is not unique in having a number of current biomass power plant proposals. Vermont currently has 5 to 8 proposals in varying stages of discussion; New Hampshire has two major projects that have come and gone over the past few years; etc.[12] To further illustrate the scale and scope of biomass power plant proposals across the region, over the past ten years, there have been 243 biomass power plant proposals in the ISO New England region, with only one new plant constructed Schiller Power Plant, NH).

Overall, federal and state policies and incentives are responsible for the trend within the biomass industry to propose large-scale electric generation facilities in Massachusetts and elsewhere in the country.

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11 $30–$35 per ton for wood purchase is the breaking point as reported in interviews with the Ryegate and Schiller power plants and is also consistent with independent research conducted by the Biomass Energy Resource Center.

12 Recent Vermont biomass power plant proposals include: 20–25 MW plant in Ludlow, 20–30 MW plant in Rutland, two 20–30MW combined pellet mill/biomass plants in Pownal and Fair Haven, 20–30MW plant in North Springfield. Recent New Hampshire biomass power plant proposals include: 70MW power plant in Berlin, 50–70 MW power plant (in combination with a cellulsosic ethanol plant) in Groveton.

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