WOODY BIOMASS
The Path Toward a Sustainable Use of Vermont's Forests

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VERMONT LAW SCHOOL

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EXECUTIVE SUMMARY

Purpose

Woody Biomass: The Path Toward a Sustainable Use of Vermont's Forests was developed as an effort to ensure that Vermont takes the necessary steps and adopts appropriate environmental standards to account for the increased use of woody biomass for energy. With worldwide increased interest in developing renewable energy to replace fossil fuels and address climate change concerns, woody biomass has been defined by many laws and regulations as a renewable energy source. Vermont, with 78 percent of the state forested, has the potential to increase the use of this renewable resource, and consequently reduce its dependency on fossil fuels and mitigate climate change. In order to ensure that this resource is developed in accordance with sustainable forestry strategies,[1] it is important to consider the impacts that increased harvesting of woody biomass for energy will have on the health of regional forests. This report begins with a literature review of woody biomass as an energy resource. Then it assesses the challenges presented by the further development of this resource. Finally, the report offers recommendations to ensure that necessary measures are in place to protect long-term forest health.

READER'S NOTE

As broadly defined by the United States Forest Service, woody biomass is "[t] he trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management."

Source: United States Forest Service, *What is woody biomass utilization?*.

Key Findings

Despite the potential benefits from using biomass for energy, the literature on woody biomass presents a number of environmental concerns related to its increased use. Those concerns vary from harvesting activities to the combustion of wood for energy production. The central concerns from harvesting are connected to forest health and productivity: soil and water quality, biological diversity and wildlife habitat, and effects on carbon storage. Regarding woody biomass combustion, the main concern refers to pollutant and greenhouse gas (GHG) emissions. The GHG emissions concern is relatively new; historically biogenic emissions were considered

[1] As explained by Vermont Department of Parks, Forests, and Recreation, sustainable manner is the "management of forests that maintain their health, productivity, diversity and overall integrity in the long-run, in the context of human activity and use," present and future (Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 2010)).

neutral due to the natural carbon cycle of biomass sources. However, new studies have challenged the presumption of carbon neutrality of biogenic emissions, leading the U.S. Environmental Protection Agency (EPA) to revise its biogenic emissions accounting framework from stationary sources in 2010, and to decide whether specific discounting system for emissions from biomass-fired units should be adopted, as further explained in Section I. In a state committed through statutory provisions to reduce emissions from GHGs up to 75 percent by 2050,[2] the proper accounting of carbon emissions from woody biomass is vital.

Additional key findings in the report include:

- Vermont has great potential to supply additional sustainable woody biomass for energy purposes as reported by the U.S. Department of Energy and the Biomass Energy Resource Center;
- Vermont has aggressive goals established in 2011 Comprehensive Energy Plan towards increasing renewables in the state's energy mix by 2050 (90 percent),[3] and woody biomass is expected to play a key role in meeting those targets;
- To be considered environmentally sustainable, woody biomass should come from suppliers that adopt sustainable forest management practices and promote forest health;
- Existing laws and regulations at the federal and state levels aim to address forestry concerns related to harvesting activities, in particular activities developed in public lands;
- There is an urgent need to address the particularities related to harvesting from woody biomass, including concerns regarding greater biomass removal and shorter rotations removal when compared to traditional industries, such as pulp and mill;
- Forests are part of larger landscape which does not follow political boundaries, and woody biomass flows freely in the regional economy;
- Efforts to protect Vermont's forests from negative impacts of an increased demand for woody biomass should be combined with regional agreements among Northeastern states, avoiding a "race to the bottom" situation;

[2] 10 V.S.A. § 578 (a).
[3] Vermont Public Service Department (December, 2011).

- Northeastern states have a long history of participation in multi-state environmental initiatives, including the New England Governors' Conference and the Regional Greenhouse Gas Initiative (RGGI);
- The European Union approach of setting minimum standards to ensure that biomass is sustainably harvested sets a useful model for Northeastern states to follow, allowing individual states to adopt additional guidelines as appropriate;
- The definition of eligible woody biomass vary greatly among Northeastern states' Renewable Portfolio Standard (RPS) and equivalent programs, which may frustrate individual states' attempt to protect the health and productivity of their forests; and
- The use of woody biomass for transportation and heating fuels in neighboring states could also impose additional pressure on Vermont's forests in the near future.

The Path Forward

In response to the challenges and concerns an increased use of woody biomass for energy presents, this report makes some recommendations to be adopted at the state and regional levels. The first recommendation is to develop biomass harvesting guidelines that expressly address specific forestry concerns related to harvesting for woody biomass and ensure that sustainable forest management practices are in place within state boundaries. A second recommendation is to adopt procurement standards for woody biomass in order to ensure that public, government, and private sectors are procuring wood that promotes excellent forestry. Additionally, Vermont can adopt a certification process for both programs, which may vary from self-reporting, second-party verification, or third party certification.

Other key recommendations provided in this report include:

- The adoption of a uniform definition of "eligible woody biomass" under RPS and other renewable energy programs across Northeastern states and/or RGGI member states to ensure that only sustainable woody biomass can be accounted for these programs and goals' compliance, and awarded Renewable Energy Credits (RECs) or equivalent;
- Northeastern states should establish minimum sustainability criteria, such as efficiency level, and emission limits;

- Northeastern states should engage in developing regional biomass harvesting guidelines and procurement standards to be followed by those interested in harvesting and procuring woody biomass for energy;
- In a similar approach to the European Union, individual U.S. states should maintain the discretion to address specific features of their forests through additional guidelines and standards; and
- The adoption of Thermal Renewable Energy Credits (TRECs), or comparable tool, could ensure that similar sustainable standards for wood-fired biomass electric facilities are applied to heat units.

Content and Structure of the Report

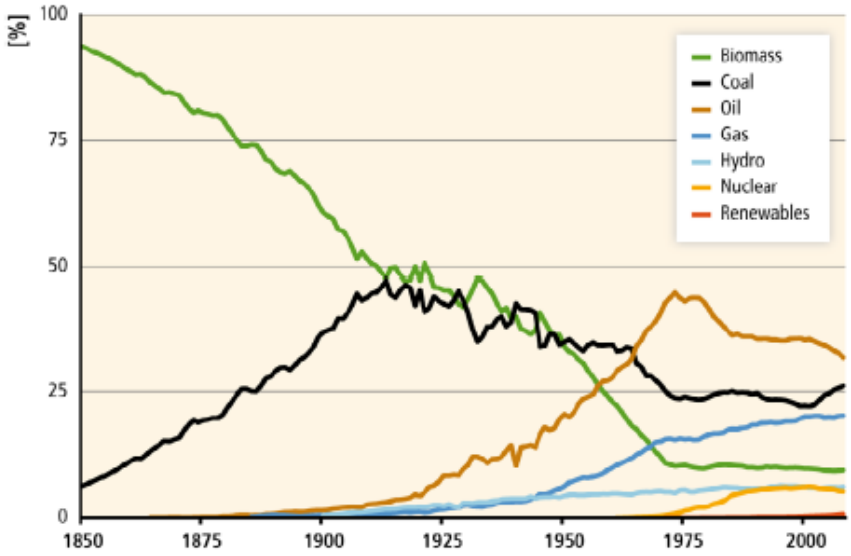
Through extensive legal research and a review of existing literature, this report incorporates the best data and recommendations from a broad range of organizations which address forest health and sustainability concerns regarding the increased use of woody biomass for energy. This report is divided in five main parts. The Introduction provides an overview of the reasons behind the increased demand for woody biomass for energy and the role Vermont's forests will play in this scenario. Part I analyzes environmental concerns related to harvesting, in particular biomass harvesting[4] for energy production, and its impacts on soil and water quality, biological diversity and wildlife habitat, and carbon emission and storage. Part II contains an overview of key federal and state laws and regulations that aim to address environmental concerns from woody biomass harvesting. Part III points out existing gaps in the current framework and proposes the adoption of biomass harvesting guidelines, procurement standards, and certification processes. Part IV highlights a need for regional sustainability standards, in particular a uniform definition of eligible woody biomass under RPS programs, and other renewable energy programs, including Vermont's current Sustainably Priced Energy Enterprise Development (SPEED) program.

[4] The term "biomass harvesting" is used in this report to refer to harvesting activities that are mainly developed to gather woody biomass resources for energy generation.

INTRODUCTION

> *"Managing forests sustainably involves a recognition of the ecological, social, and economic systems necessary to maintain forest health while providing benefits for this and future generations."* Steven Sinclair, Director of Vermont Department of Forests, Parks & Recreation.[5]

Using wood as a source of energy is a well-known part of human history. Considered the world's oldest energy source, woody biomass was the primary source of energy for American families until the mid-to-late 1800s.[6] With the beginning of the 19th century, the use of woody biomass for energy has declined considerably, as a result of the increased use of coal and fossil fuels as primary energy supplies.[7]



[8]

However, with intensified debates over climate change and states setting targets for reducing greenhouse gas (GHG) emissions, interest in renewable energy has grown significantly. In addition to climate change mitigation, the United States (U.S.) has been searching for decades for alternatives to address the energy security issues related to dependency on foreign energy sources. While other renewable sources, such as solar, wind and geothermal, provide great alternatives, woody biomass is once again seen as an attractive energy source.

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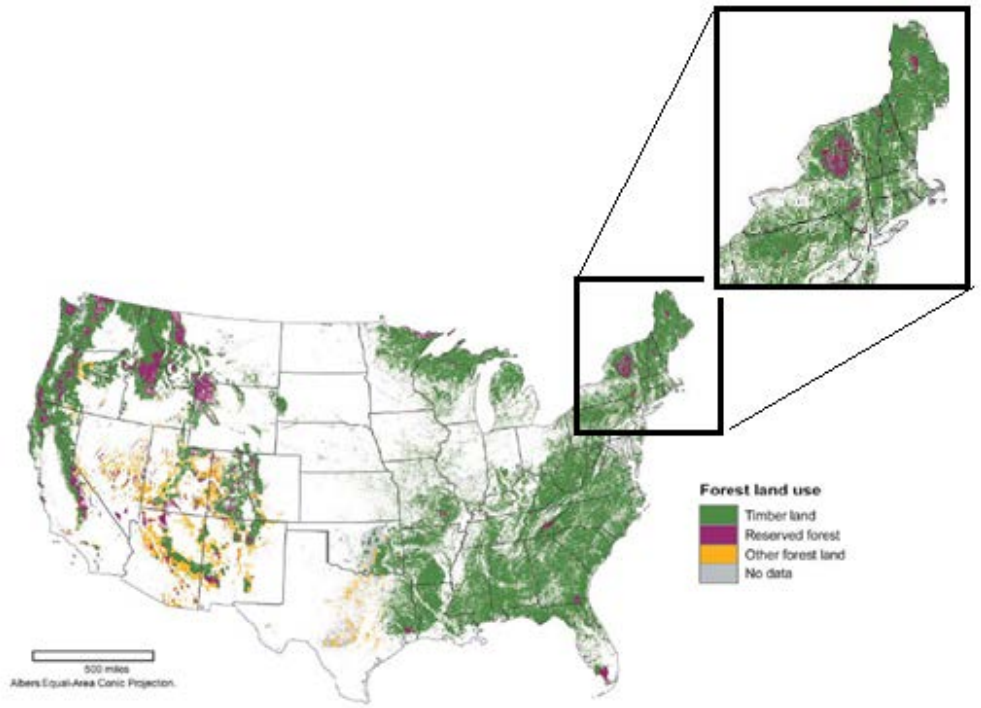
[5] North East State Foresters Association (Vermont, 2003).
[6] United States Energy Information Administration (July, 2013).
[7] *Id.*
[8] Intergovernmental Panel on Climate Change, Working Group III (December, 2013).

There are a number of reasons that justify the increased interest in woody biomass for energy. First, if forest harvests are properly managed, woody biomass is a renewable energy and should be encouraged at the federal and state levels. The second main reason refers to the potential of wood to generate energy for electricity, heat, and transportation fuel. Third, wood is spread among numerous states, contrary to other energy sources, which are predominately located in specific areas.[9] As identified by the U.S. Department of Energy (DOE), the U.S. has around 750 million acres of forestland,[10] which provides a great local energy source for a number of states.



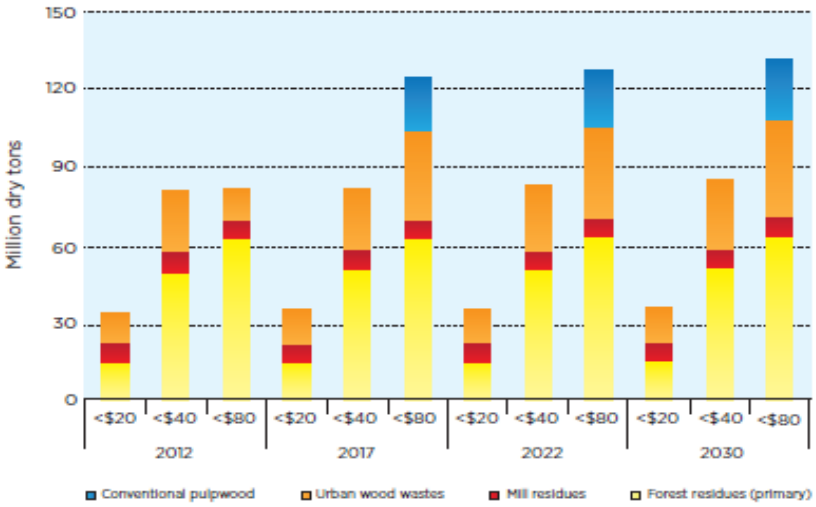
[11]

Looking into this potential, the DOE released the *Billion-Ton Study* in 2005.[12] This study aimed to analyze the U.S. potential to provide a greater supply of energy from sustainable biomass and to support an expanded role of biomass as an energy source. The study concluded that "[f]orest lands, in particular, timberlands, have the potential to sustainably produce close to 370 million dry tons of biomass annually."[13]

[9] Coal, for example, is heavily concentrated in five states (Wyoming, West Virginia, Kentucky, Pennsylvania, and Illinois), which are responsible for 70 percent of U.S. coal production (United States Energy Information Administration, *FAQ*).
[10] United States Department of Energy (April, 2005).
[11] United States Department of Energy (August, 2011).
[12] United States Department of Energy *supra* at note 10.
[13] 52 million dry tons would come from fuel wood, 145 million dry tons from wood residues from mills and pulp processing, 47 million dry tons from urban wood, 64 million dry tons from logging and site clearing residues, and 60 million dry tons from reduce fire hazards treatment operations (United States Department of Energy *supra* at note 10).

An updated version of the DOE's study was released in 2011 and provided information about the potential availability of forest biomass and wood waste according to the price of the dry ton.[14] The new numbers range from 33 million dry tons to 142 million according to the different prices, varying from $20 per dry ton to $100.[15]

Figure ES.1 Estimated forest biomass under baseline assumptions



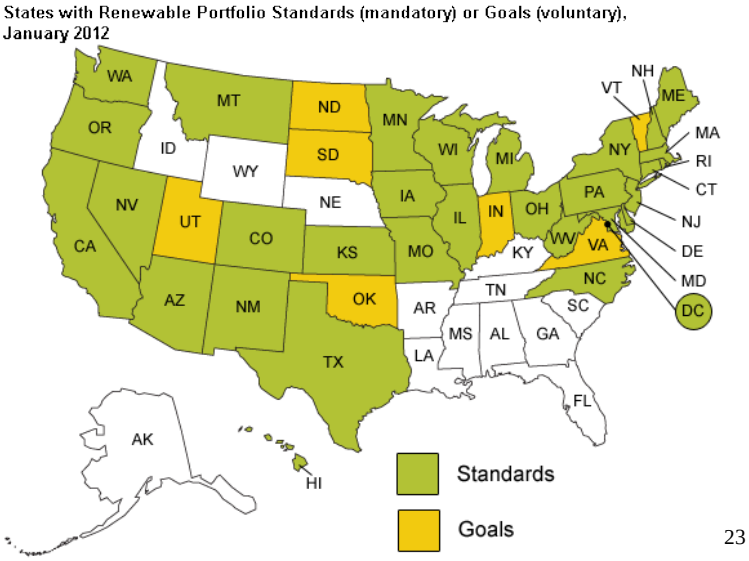
[16]

Since the *Billion-Ton Study* and its updated version were released, a number of laws have been enacted to increase biomass in the U.S. energy mix. Besides the adoption of financial mechanisms to help spur the deployment of biomass energy technologies (such as tax incentives in the Internal Revenue Code for renewable energy production,[17] or the Farm Bill's grants for Biomass Crop Assistance Program [18]), Congress has also enacted renewable fuel volume mandates. Created in 2005 under the Energy Policy Act, those mandates are known as Renewable Fuel Standards (RFS). RFS require that 9 billion gallons of renewable fuel are blended in the transportation fuel by 2008, and 36 billion gallons by 2022. Woody biomass is estimated to play a big role in achieving those goals. In a study released in 2010 by the U.S. Department of Agriculture (USDA), 2.8 billion gallons of advanced fuels are expected to come from woody biomass, [19] with 40 million gallons per year coming from the Northeast region.[20]

[14] United States Department of Energy *supra* at note 11.
[15] *Id.*
[16] *Id.*
[17] U.S. Internal Revenue Code (26 U.S.C. § 45).
[18] P.L. 113-79 § 9010.
[19] United States Department of Agriculture (June, 2010).
[20] *Id.*

Even though Vermont does not have any wood biorefinery, other Northeastern states already have such facility in place.[21]

A second initiative came from states through the adoption of Renewable Portfolio Standards (RPS) requiring that retail electric suppliers provide a minimum percentage of their load with eligible renewable sources.[22] Other states, such as Vermont, have adopted voluntary renewable energy goals, rather than RPS. While most states' programs - RPS or voluntary renewable goals - include woody biomass as an eligible renewable energy source, woody biomass definition varies greatly among the programs.

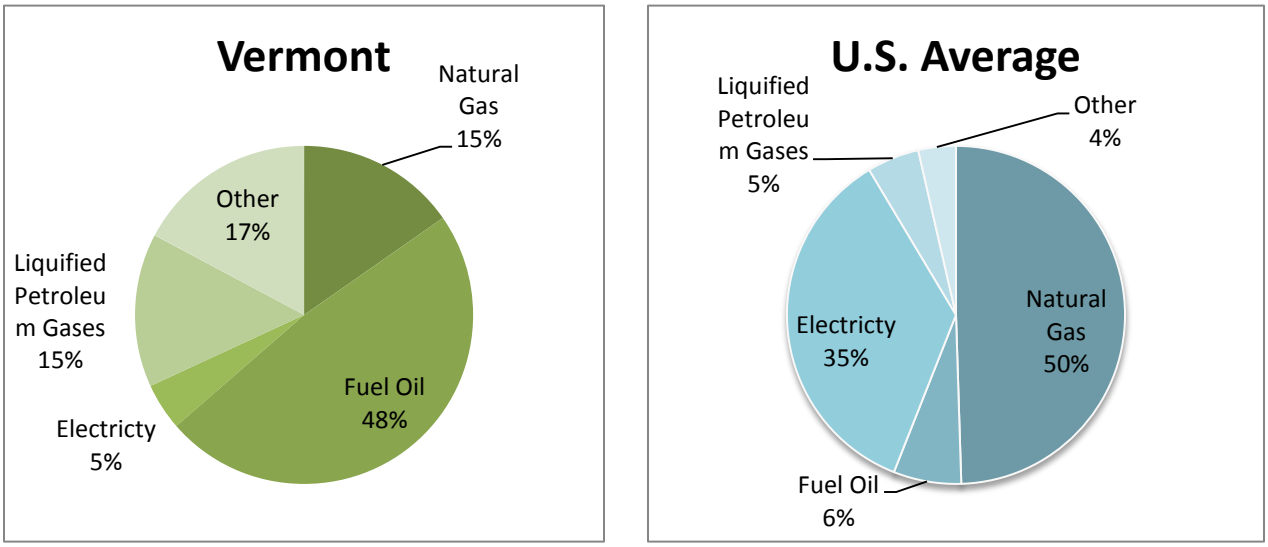


[23]

There is currently no heating mandate in place at the national level. This exclusion leaves heating as the "missing piece"[24] in climate change policy. This is especially true in the Northeastern region where nearly 80 percent of 6.9 thousand American homes that rely on heating oil are located.[25] Nonetheless, in the past years several federal initiatives have been proposed to address heating concerns, or at least to incentivize the use of renewable energy sources for heating.[26]

[21] *Id.*
[22] Miguel Mendonca, David Jacobs, and Benjamin Sovacool (October, 2009).
[23] United States Environmental Protection Agency (February 3, 2012).
[24] Heinrich Boll Foundation (April, 2008).
[25] United States Department of Energy *(Heating Oil Reserve)*.
[26] Examples include federal proposed bills, like the Thermal Energy Efficiency Act (Senate 1621); American Renewable Biomass Heating Act (House of Representatives 2080); Cleaner, Securer, Affordable Thermal Energy Act (Senate 1643); and Thermal Renewable and Efficiency Act (House of Representatives 5805).

CONSUMPTION FOR HOME HEATING IN 2012



Source: United States Energy Information Administration (August, 2014).

These studies, policies, and initiatives resulted in an increased demand of woody biomass for energy. The Energy Information Agency (EIA)'s 2011 Annual Overview shows that the U.S. consumed over 2 quadrillion British Thermal Units (Btu) from wood energy in that year,[27] representing 22 percent of all the renewable primary energy consumed in the country.[28] Heating was responsible for part of this consumption, presenting a 39 percent increase since 2004.[29] In 2012, wood for heating was being used in 2.5 million households.[30]

The use of woody biomass for energy is expected to increase in the coming years. International trade of wood, in particular wood pellets, is also starting to impact the demand for woody biomass production in the U.S. The European Union (EU) Renewable Directive 2009/28/EC establishes high renewable targets. To comply with this mandate, some EU countries are in need of foreign resources.[31] Even though there is an expectation that Southern U.S. states will be the suppliers in the short-term,[32] especially because they have better overseas transportation

[27] United States Energy Information Administration (September, 2012).
[28] *Id.*
[29] United States Energy Information Administration (*Short-Term Energy Outlook).*
[30] *Id.*
[31] Environmental Defense Fund (July 2, 2012).
[32] *Id.*

infrastructure, if done well there is a good chance other states will be attracted to participate in the international market.[33]

[33] Millinocket Maine, for instance, has a plan to export torified wood pellets to Eastern EU countries. As of July 2014, the project is still awaiting complete financing, permits, and settling of taxes owed. (Bangor Daily News (July, 2014)).

VERMONT'S ROLE IN AN INCREASED DEMAND FOR WOODY BIOMASS: PAST, PRESENT, AND FUTURE.

Vermont is also expected to see an increase in demand for woody biomass. After years of devastation from expansion of agriculture use after European settlement, Vermont's reforestation process started in the middle of the 19th century once families no longer farmed their lands. [34] Numerous reasons justify the exodus phenomenon: the effect of heavy farming and logging on land; industrialization; and recruitment for the 1861 Civil War.[35] Settlers' abandonment gave forests a chance to partially regenerate and, by 1930, a large amount of secondary forest was in place throughout the state. [36]

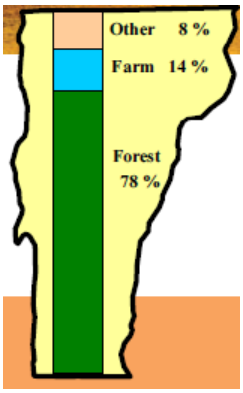
EUROPEAN SETTLEMENT IN VERMONT

In the words of Michael William, European's impact on American forests was nothing less than a complete devastation.[1] Vermont forests suffered heavily from it. With a significant increase in population from 300 to 85,000 in less than 30 years (from 1763 to 1791),[2] Vermont forests were viewed for most of the time as an "inexhaustible" resource.[3] It is estimated that between 70 to 75 percent of all native forest were cleared out during European settlement.[4] The amount of forest in the Green Mountain State cleared for agriculture and industrial felling and lumbering before 1850 jumped from 113.7 million acres to 223 million acres and 296.3 million in 1879 and 1909, respectively.[4] The use of the wood harvested varied from construction of roads, railroads, and homes, to potash, lime, iron ore, and charcoal.[5]

[1] Michael Williams (2010).
[2] Charles W. Johnson (1998).
[3] David R. Foster, and John F. O'Keefe (2000).
[4] Charles W. Johnson *supra* at note 2.
[5] Michael Williams *supra* at note 1.
[6] Perry H. Merrill (1959).

[34] Charles W. Johnson (1998).
[35] *Id.*
[36] *Id.*

Starting in 1966, "the average diameter of trees [in Vermont] has increased from 8.3 to 9.16 inches [and] the average number of trees 5 inches or larger in diameter per acre has increased from 170 to 187."[37] According to Vermont's Department of Forests, Parks, and Recreation (VT FPR), the state has 4.6 million acres of forestland, which represents 78 percent of all Vermont's territory.[38] Despite the many uncertainties and challenges state's forests face,[39] today Vermont is the fourth most heavily forested state in the U.S. [40]



Source: Eric Wharton *et al* (November, 2003).

Vermont already takes advantage of the availability of woody biomass in its territory. In 2010, Vermont had "two wood-fired power plants, 44 public schools, numerous state buildings, three college campuses, one hospital, and dozens of businesses – all using woodchips and pellets as their primary heating fuel,"[41] plus one wood pellet mill in Clarendon Town.[42]

However, several studies have looked into Vermont's significant potential to supply additional wood for energy. In 2004, the DOE estimated that Vermont has 497,200 tons of wood available, and a potential to generate 108 megawatts (MW) per year. [43] At the state level, an important study was released by the Biomass Energy Resource Center (BERC) in 2007.[44] In an effort to evaluate Vermont's forest capacity to supply wood fuel for biomass energy, BERC analyzed the potential of Vermont's 14 counties under three different scenarios: conservative,[45] moderate,[46] and aggressive.[47] For the first two scenarios, BERC found that Vermont could supply between 387,491 to 1,466,982 green tons per year, respectively. Under an aggressive scenario the amount

[37] United States Department of Agriculture *supra* at note 19.
[38] *Id*.
[39] Forests are already facing several challenges that are expected to reduce forests' net growth rate. Besides bioenergy development, some of the challenges include the introduction of invasive species, diseases, land-use change and human development, forests' maturity, tree mortality, and climate change (Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 2010)).
[40] United States Department of Agriculture *supra* at note 19.
[41] Biomass Energy Resource Center (2010).
[42] *Id*.
[43] United States Department of Energy, Office of Energy Efficiency and Renewable Energy (August, 2004).
[44] Biomass Energy Resource Center (June, 2007).
[45] The conservative scenario excludes harvesting on public lands and on privately owned lands less than 50 acres, and includes 40 percent bole volume classified as low grade and 0 percent tops and limbs.
[46] The moderate scenario is based on current patterns, including moderate harvesting on public lands, little harvesting on privately owned lands with less than 50 acres, 60 percent bole volume classified as low grade and 50 percent tops and limbs.
[47] The aggressive scenario includes increased harvesting on public lands and on privately owned lands under 50 acres, 70 percent bole volume classified as low grade, and 100 percent tops and limbs.

could reach 2,342,053 green tons per year.[48] A large amount of the volume would come from wood by-products and low-grade wood.

An updated version of the BERC study was released in 2010.[49] The new study reassessed the amount of further wood fuel capacity available in Vermont's forest for a potential increase in biomass energy demand beyond current levels of harvesting (Net Available Low-grade Growth - NALG), based on average rates of current growth on the current forest conditions.[50] The new study presented lower numbers when compared to the 2007 version, "with 0.25 – 1.9 million green tons of additional low-grade wood in Vermont that could be used as fuel," [51] with the moderate scenario limited to less than 900,000 tons.[52] The study also presented annual NALG wood from Vermont plus 10 surrounding counties.[53] The results are summarized below:

Green Tons of NALG Wood			
	Conservative Scenario	**Moderate Scenario**	Intensive Scenario
Vermont Counties	246,800	**894,900**	1,940,700
Vermont and 10 Surrounding Counties of NH, MA & NY	1,332,400	**3,107,600**	5,822,500

[54]

In addition to the great energy potential from forests, Vermont has adopted a set of policies to incentivize the use of woody biomass. Among those is the 2011 Vermont Comprehensive Energy Plan (CEP). The CEP, an effort throughout state agencies and department, aims to address "Vermont's energy future for electricity, thermal energy, transportation, and land use."[55] The plan sets Vermont's goal to become 90 percent renewable by 2050, with biomass from forests playing a key role in meeting this target. [56] As the CEP points out, the employment of woody

[48] Biomass Energy Resource Center *supra* at note 44.
[49] Biomass Energy Resource Center *supra* at note 41.
[50] As expressly stated in the report the data included tree bole (main stem), top wood, and branches, but excluded standing and downed dead wood, seedling, saplings, foliage, stumps and below-ground forest biomass.
[51] Biomass Energy Resource Center *supra* at note 41.
[52] *Id*.
[53] Cheshire, Coos, Grafton and Sullivan in New Hampshire; Berkshire and Franklin in Massachusetts; and Clinton, Essex, Rensselaer and Washington in New York.
[54] Biomass Energy Resource Center *supra* at note 41.
[55] Vermont Department of Public Service (December, 2011).
[56] *Id*.

biomass to meet Vermont's energy needs will be essential, and its low-cost can also help stabilize the energy prices in the state.[57]

Vermont has also enacted statutes setting specific emission reductions and renewable goals. One example is the GHG reduction goals, as established in 10 V.S.A § 578:

> It is the goal of the state to reduce emissions from greenhouse gases from within geographical boundaries of the state and those emissions outside the boundaries of the state that are caused by the use of energy in Vermont in order to make an appropriate contribution to achieving the regional goals of reducing emissions of greenhouse gases from the 1990 baseline by: (1) 25% by January 1, 2012; (2) 50% by January 1, 2028; (3) if practicable using reasonable efforts, 75% by January 1, 2050.[58]

In addition, Vermont established the 25x'25 Initiative, which refers to the state's goal "by the year of 2025, to produce 25 percent of the energy consumed within the state through the use of renewable energy sources, particularly from Vermont's farms and forests."[59] According to a report developed by Spring Hill Solutions, Vermont can meet the 25x'25 goal by increasing the share of wood energy into Vermont's energy mix by providing almost 9 percent of the state's energy needs.[60] This means that 14,437 billion Btu would come from woody biomass against 2004's 7,967 billion Btu. This 55 increase in energy output from forest resources would total 1.5 million green tons harvested per year by 2025, "[a]ssuming 500,000 tons of the additional harvest is dedicated to the production of cellulosic ethanol and 1,000,000 tons is dedicated to the production of electric and thermal energy."[61] Vermont's current and projected energy production from wood energy presented in the 25X'25 report are as follows:[62]

[57] *Id*.
[58] 10 V.S.A. §578 (a).
[59] 10 V.S.A. § 580 (a).
[60] Spring Hill Solutions (January, 2008).
[61] *Id*.
[62] *Id*.

Sector & Technology	Energy Type	Current Energy Production (Billion Btu)	Current Percentage of State Energy Load	Energy Production in 2025 (Billion Btu)	Percentage of State Energy Load in 2025
Wood Energy					
Firewood	Heat	5,160.0	3.05%	5,800.0	3.43%
Wood Pellets	Heat, Electric	327.00	0.19%	1,550.0	0.92%
Wood Chips for Electric Only	Electric	1,200.0	0.71%	1,720.0	1.02%
Wood Chips for Heat	Heat	520.0	0.31%	707.0	0.42%
Cellulosic Ethanol from Wood	Liquid	0	0	1,600.0	0.95%
Wood in CHP Applications	Heat, Electric	760.0	0.45%	3,060.0	1.81%
Sector Total			**4.71%**		**8.54%**

The combination of the supply capacity and renewable policies in Vermont, as well in the rest of the country, plus external factors such as increased prices of fossil fuels, will impose great pressure on Vermont's forests in the near future. The use of woody biomass for energy, in fact, was reported by the USDA as one of the most pressing forest issues, along with climate change and forest fragmentation.[63] This pressure brings into question how Vermont can ensure that its forests are harvested in a sustainable manner, and for the benefit of future and present generations. To address this concern, the present report aims to answer the following questions:

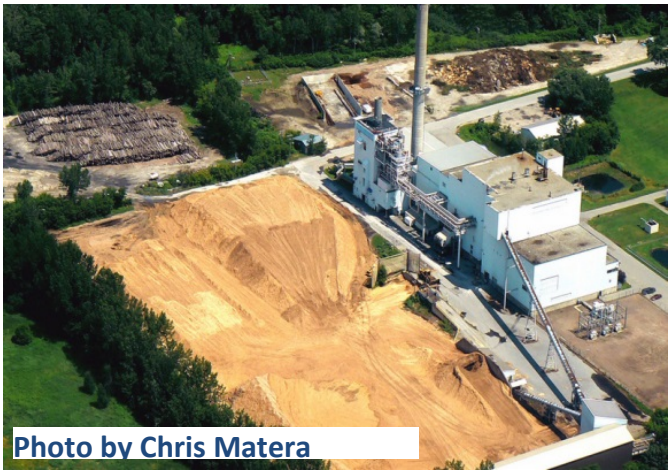
- What would a sustainable biomass market structure look like?
- Does Vermont have sufficient legal, regulatory, and monitoring tools to evaluate and respond to the cumulative impacts of the pressures on our forests from increased combustion of woody biomass?
- Where are the gaps in Vermont law and policy in regards to developing a workable market structure?

[63] United States Department of Agriculture *supra* at note 19.

- What wood procurement standards would be necessary to ensure that the continued use of woody biomass for thermal and electric energy use will be sustainable?
- Do we need a regional agreement regarding common standards? If so, what regional mechanisms or agreements would need to be in place to support a sustainable market in Vermont?

By answering those five questions, this report plans to address the main concerns regarding the increased demand of woody biomass for energy, and ensure an environmentally-sustainable woody biomass market.

WOOD-FIRED BIOMASS ELECTRIC FACILITIES IN VERMONT



Vermont has two operating wood-fired biomass electric power plants: Joseph C. McNeil Station and Ryegate Power Station. The first was developed in 1984, and it is located in Burlington. The McNeil Station has a 50MW capacity and consumes 400,000 green tons yearly at a 50 to 60 percent capacity factor. It runs primarily on wood chips, using 1.45 tons of wood to produce each MWh.[1] In 2000, 70 percent of the wood supply was wood chips from low-quality, whole tree and harvest residue, 25 percent from sawmill residue, and 5 percent from urban wood waste from areas residents.[2] Two-third of the wood supply comes from Vermont forests. The other one-third comes from New York and Quebec, and a small portion from New Hampshire and Massachusetts.[3]

The second wood-fired biomass electric power plant is located in Ryegate, Vermont. In operation since 1992, the Ryegate Station has 20 MW capacity, and it provides energy for 15,000 Vermont households and businesses.[4] The plant consumes 250,000 green tons per year of low-grade whole-trees, wood chips, and waste wood, which comes mostly from Vermont and New Hampshire forests.[5]

As explained by Vermont Public Service Department (PSD)'s 2011 Comprehensive Energy Plan (CEP), the plants, together, use as much as 43 percent of all the wood consumed in Vermont annually, which in 2011 it was predicted to be around 1.5 million tons.[6] They also produce a significant amount of electricity, helping the state to meet 6 percent of the electric load with woody biomass.[7]

Other wood-fired biomass electric power plants have also been proposed. One of them was the North Springfield Sustainable Energy power plant, which had its petition for Certificate of Public Good denied by the Vermont Public Service Board (PSB) in February, 2014. If approved, the 35 MW power plant would have burned 450,000 green tons, with 300,000 tons coming from Vermont forests.[8] The power plant would have had a harvesting footprint of 20,000 acres in the state, plus up to 448,714 tons of carbon dioxide equivalent (CO_2e) emissions per year.[9]

A second proposed wood-fired biomass electric power plant is the Fair Haven Biomass Project, owned by the Beaver Wood Energy Fair Haven, LLC. The proposed plant is a 29.5 MW biomass electricity plant and wood pellet producer.[10] The fuel for the power plant is predicted to come from locally harvested wood (within 50 miles of the plant), and be composed mostly from tree tops, branches, bark and excess wood from paper, lumber and pellet harvesting activities.[11] The power plant is expected to power 34,000 homes, while the pellet plant is expected to produce 110,000 tons of pellets per year, enough to heat 27,000 homes.[12] On November 2, 2010 the company applied for a petition for a Certificate of Public Good, pursuant to 30 V.S.A §248. The

project, which is still listed under the electric major pending proceedings in the PSB website, had its last action reported in 2011.[13]

A third proposed facility might be under way. As noticed by several newspapers, select board members of the Town of Vernon were considering the possibility of installing a biomass electric power plant at the Vermont Yankee Nuclear Power Station.[14] As reported, the plant would use as primary fuels municipal solid waste, and woody and agricultural biomass.[15] The proposal is still in its infancy, and no further information has been provided since June, 2014.

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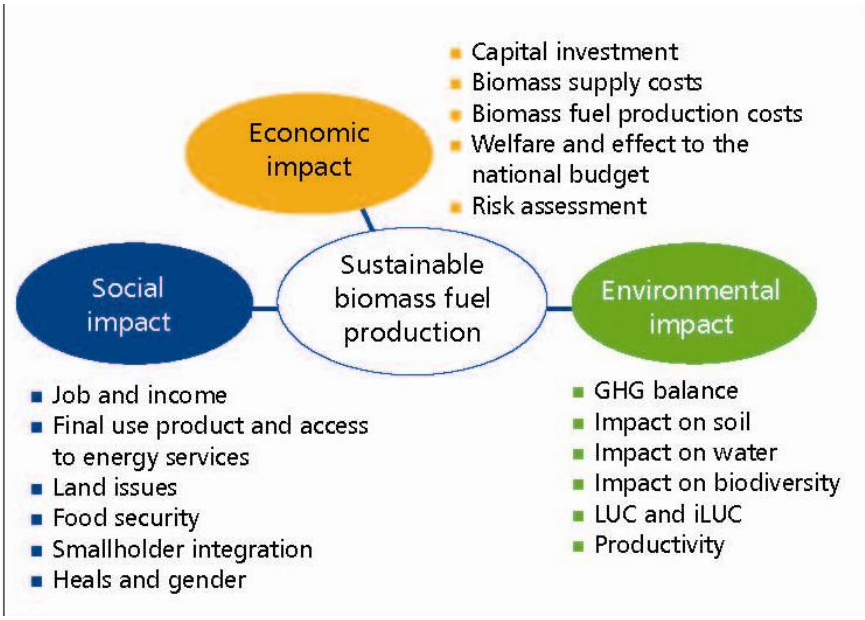
[1] Vermont Public Service Department (December 2011).
[2] Nell Campbell and Anna Mika (March, 2009).
[3] *Id*.
[4] *Id*.
[5] *Id*.
[6] Vermont Public Service Department *supra* at note1.
[7] *Id*.
[8] Vermont Public Service Board (February, 2014).
[9] *Id*.
[10] Beaver Wood Energy.
[11] *Id*.
[12] *Id*.
[13] Vermont Public Service Board (Docket 7679).
[14] VT Digger (June, 2014).
[15] The Washington Times (June, 2014).

SECTION I: SUSTAINABLE BIOMASS ENERGY MARKET

Before addressing issues regarding Vermont's policy and legal framework, it is important to understand what a sustainable biomass energy market means. The concept of sustainability was first introduced in the 1972 Conference on Human Environment.[64] Even though definitions of sustainability may vary, there is a consensus that in order to be sustainable, markets should account for three main factors: economic, social, and environmental. Those factors should also be considered in the development of a sustainable biomass market, as explained in the list of concerns related to biomass fuel production developed by EUBioNet: [65]

SUSTAINABILITY

Sustainability and renewability are concepts intrinsically related. This is due to the fact that woody biomass is a finite resource with ecological limits. If the harvested rate is higher than the replenishment rate, woody biomass can be considered neither renewable nor sustainable energy source.



[64] The concept was included in the 1972 Declaration of the United Nations Conference on Human Environment: "Principle 2. The natural resources of the earth, including air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate."
[65] EUBIONET III.

Despite the importance of all three levels of sustainability, this report does not intend to address all of them. Rather, the report will focus on ensuring that the development of a biomass energy market is environmentally sustainable, especially when considering the impacts on forest ecosystems. The decision to focus on this particular level of sustainability is intrinsically related to the relevant services forests provide to the global population and to Vermont's inhabitants in particular. As clearly explained by the U.S. Department of Agriculture (USDA):

> Forests perform many critical ecological roles. They are the lungs for the planet, cleaners of the air, catchers of rainfall and protectors of soils, filters for streams, and homes to countless species.
> Beyond their ecological roles, forests are the foundation of societies, providing places to build communities, raise families, enjoy outdoor activities, and nourish the spirit. Forests are also the foundations of economies, creating job opportunities, supplying environmental services such as clean water, and providing awe-inspiring natural splendors for tourists and residents alike.[66]

For Vermont, this statement is particularly true. After years of heavy use and conversion to agriculture and other non-forest use, Vermont's forests are now recognized as "an important aspect of Vermont´s social, environmental, and economic identity."[67] To ensure that forests will continue to provide ecological, economic, and social services, sustainable forest management (SFM) practices need to be in place. In the words of USDA, SFM practices "contribute to the resilience of ecosystems, societies, and economies while also safeguarding biological diversity and providing a broad range of goods and services for present and future generations."[68]

The idea of a SFM was first proposed in the United Nations Conference on Environment and Development in 1992.[69] Two years later, as a result of the conference and the principles adopted, the Montreal Process was created as a combined effort between temperate and boreal forest countries. The Montreal Process's goal is to provide guidance in conservation and sustainable management. To further that goal, the Montreal Process developed what is now known as the Montreal Criteria and Indicators (MPC&I). The MPC&I highlight seven essential foundations, or criteria, of SFM:[70]

- Conservation of biological diversity;

[66] United States Department of Agriculture (June, 2011).
[67] Charles W. Johnson (1998).
[68] United States Department of Agriculture *supra* at note 66.
[69] United Nations, General Assembly (June, 1992).
[70] United States Department of Agriculture *supra* at note 66.

- Maintenance of productive capacity of forest ecosystem;
- Maintenance of forest ecosystem health and vitality;
- Conservation and maintenance of soil and water resources;
- Maintenance of forest contribution to global carbon cycles;
- Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs to societies; and
- Legal, policy, and institutional framework.

Those criteria cover the many concerns presented in the literature regarding harvesting woody biomass for energy, which can be more aggressive than harvesting for different purposes. Those concerns are often broken down into four major categories: water resources, soil, biological diversity and wildlife habitat, carbon emission and storage.[71]

ADDITIONAL CHALLENGES TO VERMONT'S FORESTS

This section aims to address the potential challenges an increased demand for woody energy can impose in Vermont's forests health. While this report does not intend to be exhaustive, it does recognize that bioenergy development is just one of the many challenges forests around the globe will face in the coming decades. Along with invasive species, disease threats, and increased tree mortality, forests are also facing three confronting issues, as explained by USDA: "(1) loss of forests lands and working forests; (2) forests, climate change, and bioenergy development; and (3) changing forest health and disturbance patterns."[1] This report proposes different approaches based on the literature and information available at this moment, however it identifies that governments have the difficult task to ensure forest health in a world where the confronting "issues have the potential to change the Nation's forests dramatically in the coming years."[2] In Vermont, some of these threats are already reducing the forests' rate of accumulation - or growth rate - despite the continuing increase in wood volume.[3] Under this new scenario, harvesting standards shall be carefully determine and re-evaluated since "[f]orest health outcomes from harvesting are more unpredictable today than they were decades ago."[4]

[1] United States Department of Agriculture (June, 2011).
[2] *Id*.
[3] Vermont Public Service Board (February, 2014).
[4] *Id*.

[71] We are limiting the scope of the work in order to better address the forest health issues found to be more relevant at this point regarding a possible increase in forest harvesting for bioenergy purposes. However, we do not ignore that other environmental problems are also related to the use of woody biomass, such as the increase in other pollutants emissions (e.g. particulate matter, mercury and ozone), land use change, and environmental justice concerns regarding the siting of facilities. We also do not ignore the economic barriers regarding the implementation of a sustainable biomass market (e.g. high upfront investment, transportation costs).

Water Resources

Water quality and protection is one of the main concerns related to wood harvesting, as this activity can have great impact on water resources.[72] The importance of water can be easily understood since "[w]ater is essential for life and plays a vital role in the proper functioning of the Earth's ecosystems."[73] One of the main concerns regarding harvesting for woody biomass is water pollution, which can "negatively affect the use of water for drinking, household needs, recreation, fishing, transportation and commerce." [74]

A second concern regarding water is the high water consumption in wood-fired biomass electric facilities, as facilities using water-cooled condensers can consume great amounts of groundwater.[75] But the amount of water consumed can drop around 90 percent just by implementing different, yet usually more expensive, technologies, such as air-cooled condensers, as proposed in the North Springfield Sustainable Energy Project (NSSEP).[76]

Soil

Soils, along with water, also constitute the foundation of ecosystems, allowing them to "sustain forests, forest economies, and forest dependent societies."[77] Among other functions, soils provide habitats for numerous organisms, support hydrological processes, create favorable conditions for decomposition and regeneration (including growth of trees) by cycling and supplying nutrients and through carbon storage.[78] Healthy soils also improve forest resistance, resilience, and adaptation - important services, especially in a world threatened by climate change.[79]

"Chipping for biomass energy can be effective, but we need to do it sustainably. If we focus on wood only as a fuel source, and forget that wood is necessary component of forest soils, we could deplete our forests of organic matter and reduce their long-term productivity. Organic matter in soil holds nutrients and water and is even more important as the climate changes due to global warming."

Source: Biomass Energy Resource Center (June, 2007).

[72] Evan N. Turgeon (February, 2009).
[73] United States Environmental Protection Agency, *Water Resources*.
[74] *Id*.
[75] North Springfield Sustainable Energy Project (August, 2012).
[76] *Id*.
[77] United States Department of Agriculture *supra* at note 66.
[78] Maine Agricultural and Forest Experiment Station, University of Maine (January, 2010).
[79] Forest Guild (December, 2007).

Woody biomass harvesting can impose a great risk to soil quality and productivity. As explained by the North East State Foresters Association, "[t]he most central concern with biomass harvesting is the potential loss of soil nutrients needed for plant growth."[80] This concern is due to the fact that "harvesting biomass ha[s] the potential of removing more materials [which] may reduce the cycling of nutrients back to the soil."[81] Thus, to avoid soil depletion and decreased productivity, harvesting practices that account for nutrient supply and the rate of nutrient transformation shall be required. [82]

Biological Diversity and Wildlife Habitat

Biological diversity (or biodiversity) and wildlife habitat are other areas of great concern. Biodiversity represents the "variety and variability of organisms"[83] within an ecosphere "from genetic to species to ecosystems."[84] Biodiversity provides food, clothing, shelter and medicine for people, [85] and can be a great source of income for families. Besides material goods, biodiversity is also important for the health and complexity of structural features of the environment since it provides natural services, such as soil fertility, sustaining the movement of water, absorbing and detoxifying pollutants, and decomposing waste.[86] A biologically diverse forest "enables an ecosystem to respond to external influences, to recover after disturbances, and to maintain essential ecological processes."[87]

It is well-known that "[t]he more species living in an ecosystem, the higher its productivity and the greater its ability to withstand drought and other kinds of environmental strain."[88] In the alternative, the loss of biodiversity can result in the reduction of the "efficiency by which ecological communities capture biologically essential resources, produce biomass, decompose and recycle biologically essential nutrients."[89] Biodiversity is such a complex web which the

[80] North East State Foresters Association (July, 2012).
[81] Ben Larson *et al* (November, 2012).
[82] Maine Agricultural and Forest Experiment Station *supra* at note 78.
[83] Phil Franks and Thomas Blomley (2004).
[84] Vermont Agency of Natural Resource; Department of Forests, Parks, and Recreation (June, 2010).
[85] Ruth Patrick (1997).
[86] Norman Myers (2001).
[87] United States Department of Agriculture *supra* at note 66.
[88] Edward O. Wilson (2001).
[89] *Id*.

"loss of certain life forms could substantially alter the structure and functioning of whole ecosystems."[90]

There are two problems regarding loss of biodiversity that are often related to woody biomass harvesting. The first is the harvesting itself, which threatens the renewability of trees. Even though woody biomass is considered a renewable resource, if forests are harvested at a faster rate than they can be replenished, wood cannot be sustainable, and thus is not renewable. According to the Natural Resources Defense Council, this is what is happening now, when "most of the biomass we use commercially today comes from resources that are not sustainable."[91]

The second problem is the loss of species that depend on forests to survive. Vermont's forests, for instance, are estimated "to be home to 441 species of birds, mammals, amphibians, and reptiles,"[92] with the "majority of these species [being] dependent on forest for all or part of their life-cycles," [93] such as the song sparrow, American goldfinch, and moose. [94] Additionally, different species rely on different types and ages of forests. For example, pileated woodpeckers, porcupines, black bears, beavers, white-tailed deer, and wild turkeys are among the species that rely on mature stands.[95] Bear, deer, blue jays, turkeys, gray foxes, and striped skunks rely on seeds produced by overstory trees for food.[96] Birds and small animals also use standing dead and cull trees as feeding and nesting sites.[97] Tree tops, snag trees, and large diameter down trees (greater than 8 inch diameters) provide "habitat, food sources, and forest floor structure to maintain biodiversity potential."[98] At least 40 species rely on down woody material (DWM) in New England.[99] Standing snags or on coarse woody material provide habitat for reptiles and amphibians.[100]

Among the concerns related to harvesting wood for energy is the potential to "alter the structures within forest stands and ecosystems that diverse species rely upon,"[101] and negatively impact

[90] Bradley J. Cardinale *et al* (June, 2012).
[91] Natural Resources Defense Council, *Biomass Energy and Cellulosic Ethanol*.
[92] Vermont Monitoring Cooperative (October, 2009).
[93] *Id*.
[94] Eric Wharton *et al* (November, 2003).
[95] *Id*.
[96] *Id*.
[97] *Id*.
[98] Vermont Public Service Board (February, 2014).
[99] Forest Guild (May, 2010).
[100] Caitlin Cusack (2008).
[101] Ben Larson *et al supra* at note 81.

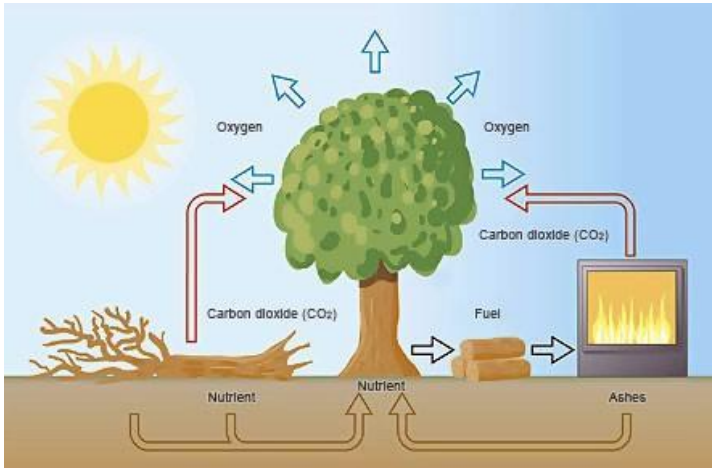
"species and communities that are not resilient to disturbance."[102] State initiatives, such as the Vermont Coverts, help landowners to adopt "practices and principles of stewardship for the enhancement of wildlife."[103]

Carbon Emission and Storage

Finally, but not of least importance, is the concern regarding carbon emission and storage related to harvesting woody biomass for energy. The carbon emission concern has increased in the past years, especially after the concept of carbon neutrality for biomass sources started to be questioned by scientists around the world. The idea behind the carbon neutrality of woody biomass comes from the natural carbon cycle, simply explained as follows:

> [P]lants remove CO_2 from the air through photosynthesis, and sequester the carbon as woody biomass. When a plant decomposes or is burned, the carbon is re-released into the atmosphere as CO_2. This process results in no net gain or loss in carbon in the earth´s surface or atmosphere.[104]

Based on this concept, the use of woody biomass to produce energy would not impact overall greenhouse gas (GHG) emissions, and, consequently, not contribute to climate change. A simplistic view of the natural carbon cycle is represented in the figure below:



105

[102] *Id.*
[103] Vermont Coverts, Woodlands for Wildlife.
[104] In contrast to oil, which "also contains carbon, but carbon that was sequestered millions of years ago. Pumping oil to the surface of the earth and burning it results in an increase in the amount of carbon on the earth´s surface. Since plants absorb a constant amount of CO2, most of the CO2 released from burning oil stays in the earth's atmosphere, contributing to global warming."(Evan N. Turgeon *supra* at note 72).
[105] InterSomma, LLC.

However, the carbon neutrality of woody biomass has been reviewed by a number of studies since the 1990s, and conclusions vary significantly.

The Manomet Center for Conservation Sciences (Manomet) published a study in 2010 aiming "to help inform [the Massachusetts] legislature as to the feasibility of substituting wood biomass for coal in some of its electrical power generation."[106] The study presented major findings regarding the use of woody biomass for energy.[107] When compared to coal and natural gas electricity, the carbon debt from using woody biomass was found to take 21 and 90 plus, respectively, to be offset. Compared to oil-fired thermal and Combined Heat and Power (CHP), the use of woody biomass was found to be offset in 5 years (20 to 30 years if replacing natural gas thermal).[108] After those years, the use of woody biomass would provide carbon dividends, or "atmospheric greenhouse gas levels that are lower than would have occurred from the use of fossil fuels to produce the same amount of energy."[109] The Manomet study calculated the carbon dividends from 2009 as follows:[110]

BIOMASS CUMULATIVE % REDUCTION IN CARBON EMISSIONS
(Net of Forest Carbon Sequestration)

YEAR	Oil, Thermal/CHP	Coal, Electric	Gas, Thermal	Gas, Electric
2050	25%	-3%	-13%	-110%
2100	42%	19%	12%	-63%

However, several other, quite different, studies have been presented since Manomet released in 2010 the *Biomass Sustainability and Carbon Policy Study*. Some studies criticized the Manomet for "under-representing the actual carbon impacts of biomass energy."[111] Others have challenged

[106] Roger A. Sedjo (April, 2013).
[107] Manomet Center for Conservation Sciences (June, 2010).
[108] *Id*.
[109] *Id*.
[110] *Id*.
[111] Mary S. Booth (July, 2010). Criticized assumptions pointed out by the author included that: (i) large trees, rather than understory cull trees, are used as biomass fuel; (ii) stands cut for biomass are not re-harvested until carbon resequestration has been achieved; (iii) only lands already cut for timber are harvested for biomass; (iv) that a large portion of 'low-carbon' tops and limbs from timber harvesting are available for biomass fuel and that removal of this amount of material will not harm forest

"the assumption that there is always a carbon debit incurred and then a carbon dividend later (debit-then-dividend) when using woody biomass for energy."[112] Despite the approach adopted, the automatic assumption of carbon neutrality from biogenic sources is no longer in place,[113] leaving legislators and policymakers with the difficult task of evaluating the short and long-term emission benefits of implementing woody biomass policy.

In 2012, the state of Massachusetts reviewed the definition of renewable biomass under its Renewable Portfolio Standard (RPS).[114] As a result, Massachusetts decided to require higher efficiency standards for biomass units to qualify for Renewable Energy Credits (RECs) and to decrease the economic value of biomass energy below 60 percent efficiency.[115]

The U.S. Environmental Protection Agency (EPA) is also in the process of revising its long-time policy regarding the carbon neutrality of woody biomass. Released in 2011, EPA's accounting framework for biogenic carbon dioxide (CO_2) emissions from stationary sources[116] aimed to adjust the total on-site biogenic emissions by analyzing "carbon stored by growth of biologically based feedstocks."[117] The end result was the development of a biogenic accounting factor (BAF) that "reflects changes in carbon stocks that may occur off-site when biogenic feedstocks are used in stationary sources."[118] Although the framework departs from EPA's acceptance of the carbon neutrality from biogenic emissions, and its past position of not accounting for those emissions, the framework retains the idea that a:

> [F]undamental difference exists between fossil and biogenic CO_2 which is not reflected in on-site emission totals. Specifically, CO_2 emissions from the consumption of fossil fuels will inevitably increase the amount of carbon in the atmosphere on policy-relevant time scales, but such an outcome is not inevitable with the consumption of biologically based feedstocks.[119]

With no specific procedure to account for biogenic carbon emissions, EPA's framework deferred CO_2 emissions accounting from bioenergy and other biogenic sources under the Clean Air

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ecological function; (v) soil carbon emissions do not increase with harvesting; (vi) indirect land use effects do not occur; and (vii) pellet manufacturing does not incur a greater carbon debt that using green wood chips.

[112] William Strauss (May, 2011).
[113] World Business Council for Sustainable Development (January, 2013).
[114] Massachusetts Office of Energy and Environmental Affairs, *Renewable Portfolio Standard.*
[115] Massachusetts Office of Energy and Environmental Affairs, *Biomass*.
[116] United States Environmental Protection Agency (September, 2011).
[117] *Id*.
[118] *Id*.
[119] *Id*.

Act.[120] During the 3-year deferral period,[121] EPA is conducting "a detailed examination of the science associated with biogenic CO_2 emissions from stationary sources, including engaging with Federal partners, technical experts, and an independent scientific panel to consider technical issues."[122] The main purpose of the examination period is to decide "whether the Clean Air Act would allow the use of some kind of discounting system or other method reflecting the net impacts of biomass combustion in determining the applicability of the pre-construction requirement to CO_2 emissions from biomass-fired units."[123] Even though the deferral period expired on July 21, 2014, to date the EPA has not adopted a specific procedure to account for biogenic carbon emissions.[124]

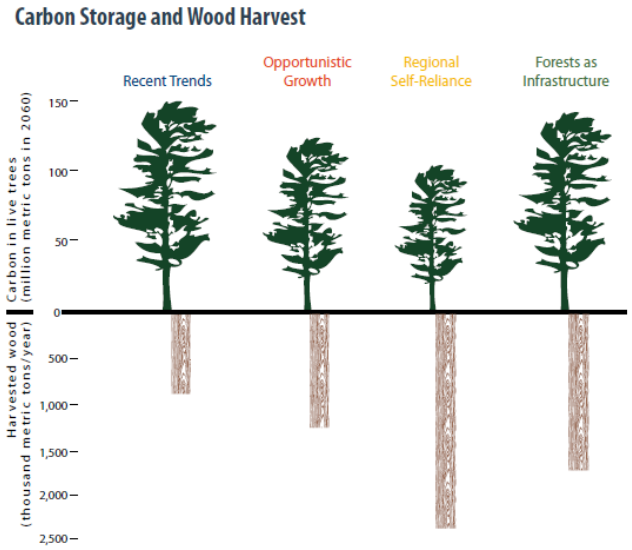
Despite the uncertainty on how EPA will account biogenic carbon emissions, the basic fact is that "ignoring the complex relationship between forest carbon stocks and biomass harvest by employing carbon neutrality assumption overstates the GHG mitigation performance of forest bioenergy and fails to report delays in achieving overall emissions reductions."[125] In states like Vermont, with established emission reduction goals, such impacts from the use of woody biomass for energy, especially in the short-term, should be considered.

Another concern woody biomass harvesting presents is the possible decrease of carbon storage. As the Vermont Agency of Natural Resources' Division of Forestry explains:

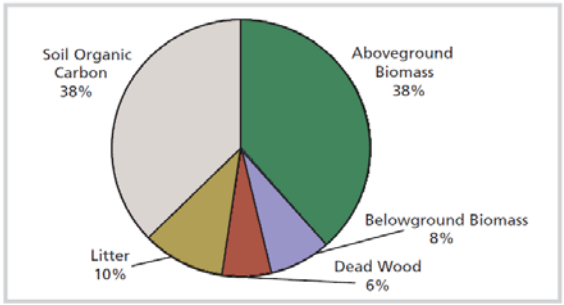
> Forests play an important role in reducing carbon in the air, as they take in CO_2 through photosynthesis and stores carbon in their wood, branches, foliage and roots. Carbon can be stored for a long time periods in trees and in soils (carbon stock), and healthy trees continue to take in additional CO_2 each year (carbon sequestration).[126]

[120] 40 CRF Parts 51, 52, 70, and 71 [EPA–HQ–OAR–2009–0517; FRL–9152–8]: Deferral for CO2 Emissions from Bioenergy and Other Biogenic Sources under the Prevention of Significant Deterioration (PSD) and Title V Programs.
[121] In *Center for Biological Diversity v. Environmental Protection Agency* (722 F.3d 401), the D.C. Court of Appeals vacated EPA's deferral rule for being arbitrary and capricious (July, 2013). However, the ruling would only be put into effect after the Supreme Court decided *Utility Air Regulatory Group v. Environmental Protection Agency*, which occurred last July. Even though the Supreme Court found that "EPA may not treat greenhouse gases as an air pollutant for purposes of determining whether a source is a major source required to obtain a Prevention of Significant Deterioration (PSD) or Title V permit," (No. 12-1146) in a Memorandum issued in July, 2014 the EPA explains that its "work regarding the biogenic CO2 assessment framework remains ongoing and is not directly impacted by the Supreme Court's decision." (United States Environmental Protection Agency (July, 2014)).
[122] 40 CRF Parts 51, 52, 70, and 71 [EPA–HQ–OAR–2009–0517; FRL–9152–8].
[123] Lisa Jackson (January, 2011).
[124] In November, 2014 EPA released a second draft of the technical report "Framework for Assessing Biogenic Carbon Dioxide for Stationary Sources", which is currently subjected to further review.
[125] Jon McKechnie *et al* (2011).
[126] Vermont Agency of Natural Resources, Division of Forestry, *Climate Change and Forests*.

A Harvard University study focused on Massachusetts' changing landscape recently analyzed the deep connection between wood harvesting and carbon storage. The information provided in the study is represented in the following graph:[127]



Carbon is stored in forests in the form of living trees, roots, or decay material in the soil.[128] Forests are estimated to store as much as 22 percent of all the carbon on the world's land surface.[129] Another 650 million metric tons of additional CO_2 are sequestered every year, "offsetting close to 11 percent of total U.S. annual carbon emissions."[130] In New England these numbers are estimated to be even greater. In 2007, the region forests were estimated to store around 6.8 billion tons of carbon.[131]



Source: Forest Guild (December, 2007).

In Vermont, forests and wood products also play a key role in mitigating the state's GHG emissions. In 2005, for example, forest and wood products were responsible for the storage of roughly 9 million tons of CO_2 ($MMtCO_2$), while the overall state's GHG emissions were

[127] The Harvard Forest, Harvard University (2014).
[128] Vermont Monitoring Cooperative *supra* at note 92.
[129] *Id.*
[130] United States Department of Agriculture *supra* at note 66.
[131] Forest Guild *supra* at note 79.

estimated at 9.07 $MMtCO_2$ for the same year. [132] In 2009, the Vermont Monitoring Cooperative reported a significant increase in the annual accumulation of CO_2 in Vermont's forests, estimating that per year statewide forests accumulate 9.63 MMt of CO_2e: [133]

Vermont Forests	Stored Carbon (MMt)	Annual Accumulation of CO_2 (MMt)
Soil	139	0.7
Forest floor	45.7	0.5
Down dead	12.2	0.4
Understory	3.2	0.03
Standing dead	11.4	0.3
Live trees	172.2	6.3
Wood products		1.4
Total	**383.7**	**9.63**

Table 3: *Estimates of carbon stored in Vermont forests and the annual removal of CO_2 from the atmosphere through forest sequestration.*

[132] "Sustainable forestry is the management of forests that maintain their health, productivity, diversity and overall integrity in the long - run, in the context of human activity and use." (Vermont Agency of Natural Resource; Department of Forests, Parks, and Recreation *supra* at note 84).
[133] Vermont Monitoring Cooperative *supra* at note 92.

NORTH SPRINGFIELD WOOD-FIRED BIOMASS POWER PLANT AND VERMONT'S GHG EMISSION REDUCTION GOALS

Vermont's goals to reduce its carbon footprint were recently reaffirmed by the Public Service Board (PSB). After analyzing the North Springfield Sustainable Energy Project (NSSEP)'s petition for a Certificate of Public Good (30 V.S.A. § 248), the PSB decided to deny the certificate because, among other reasons, "the proposed annual use of 300,000 green tons of the wood from Vermont's forest would reduce opportunities to use that fuel for more efficient uses in the future."[1] The NSSEP, a 35MW wood-fired biomass electric generating facility, would have burned 450,000 tons of whole-tree harvesting, having an annual harvesting footprint in Vermont of 20,000 acres.[2]

The PSB decision was based on three major factors: (i) the project would unduly interfere with the orderly development of the region; (ii) the project does not meet a need for present and future demand for service which could not be otherwise provided through the adoption of energy efficiency and load-management measures; and (iii) the project would not promote the general good of the state of Vermont, with consideration given to the Project's expected annual GHG emissions and low levels of thermal efficiency at which the Project would operate (30 V.S.A. Section 248 (a)(2)).

The third factor is not related to air pollution statutes. In fact, the project's estimated emissions were in compliance with federal and state air control regulations. However, the PSB found that the same was not true under the public good criteria and Vermont's policy to reduce GHG emissions. As the PSB affirmed, the potential of the project to emit up to 448,714 tons of CO_2e per year, combined with the lack of carbon accounting performance, provided no prediction for when "the project would result in a carbon-beneficial outcome,"[3] even when compared to fossil fuel sources. This uncertainty is even greater due to the thermal efficiency level of the project. As stated by the PSB, the project's thermal efficiency would be no higher than 28 percent, making the thermal output of the project considerably lower when compared to other thermal sources:

> "Thermal uses of wood for energy (residential, wood stoves, pellet stoves and boilers, institutional woodchip heating, industrial process energy and biomass district heating) are far more efficient than the project, with seasonal efficiencies greater than 60% and some greater than 80%."[4]

This created an uncertainty as to the impact of the project on Vermont's GHG reduction goals. Thus, combining the project's expected annual GHG emissions and the low thermal efficiency of the plant, PSB reached the conclusion that the burdens of the project outweighed the benefits.

Even though the PSB stated in its decision that the ruling should not be interpreted as a denial to all wood- fired biomass electric facilities, the Director of the Partnership for Policy Integrity, Mary Booth, noted a common trend: "[w]hen policymakers see that bioenergy involves harvesting forests and burning the wood in low- efficiency power plants, they conclude that large-scale bioenergy isn't compatible with greenhouse gas reduction goals."[5] In other words, the generation of electricity from wood in the state would be partially preempted since the PSB already "found that allowing a huge proportion of the forest to go to one of the least efficient uses did not amount to good stewardship."[6]

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[1] State of Vermont Public Service Board (February, 2014).
[2] *Id*.
[3] *Id*.
[4] *Id*.
[5] Partnership for Policy Integrity (February, 2014).
[6] Rutland Herald (February 16, 2014).

SECTION II: LEGAL FRAMEWORK

This section is dedicated to the existing legal framework developed to address the issues presented above. There are a number of federal acts that aim to protect U.S. forests from the negative impacts of human activities, including harvesting. At the state level, there are several laws and regulations addressing forest concerns during harvesting activities.

FEDERAL LEGISLATION

The U.S. Congress recognizes the importance of balancing the different interests regarding the forest ecosystem. There are several laws which aim to ensure that different, and sometimes conflicting, values are taken into account and do not impair future generations. The forest protection laws, however, are directed to public lands, in particular national forests.

Multiple-Use Sustained Yield Act (MUSYA) [134]

The MUSYA seeks "to direct that the national forests be managed under principles of multiple use and to produce sustained yield of products and services." Multiple-use includes: outdoor recreation, range, timber, watershed, and wildlife and fish purposes. Additionally, it seeks to achieve and maintain "a high-level [of] annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."[135] Part of the Act authorizes the Secretary of Agriculture to develop standards for the sustainable use of renewable forest resources,[136] and requires the Secretary to consider other natural resources in the area.[137]

National Forest Management Act (NFMA)[138]

The NFMA governs national forests as one of the nation's "renewable resources" which must be properly managed.[139] Part of the stated purpose of NFMA is "to serve the national interest, and in so doing, the renewable resource program must be based on a comprehensive assessment of present and anticipated uses, demand for, and supply of renewable resources from the Nation's

[134] 16 U.S.C. §§ 528-531.
[135] 16 U.S.C. § 531(b).
[136] 16 U.S.C. § 529.
[137] *Id.*
[138] 16 U.S.C. §§ 1600 et. seq.
[139] 16 U.S.C. § 1600(1).

public and private forests and rangelands."[140] The assessment is developed "through analysis of environmental and economic impacts, [and] coordination of multiple use and sustained yield opportunities as provided in the Multiple-Use Sustained-Yield Act of 1960."[141] Under NFMA private forest landowners are encouraged to adopt "efficient long-term use and improvement of these lands and their renewable resources consistent with the principles of sustained yield and multiple use."[142]

Healthy Forest Restoration Act of 2003 (HFRA)[143]

The Healthy Forest Restoration Act was developed, among other reasons, to improve the capacity to reduce wildlife risk to communities, municipal water supplier, and other at-risk Federal land; improve commercial value of forest biomass for electricity production, and others; address threats as catastrophic wildfire; and to protect, restore, and enhance forest ecosystem components.[144] Some of the programs included in the Act are the hazardous fuel projects, biomass programs and grants, and healthy forest reserve program.

Agricultural Act of 2014 (Farm Bill)[145]

The 2014 Farm Bill maintained some of the past programs related to biomass for energy, such as Rural Energy for America Program (§ 9007) and expanded other programs (e.g. Biomass Crop Assistance Program).[146] The Farm Bill also continued the Community Wood Energy Program,[147] to assess available feedstocks and long-term feasibility of supplying and operating a community wood energy systems owned or operated by state or local governments that use biomass as primary fuel.[148] The eligible systems, including single facility central heating, district heating, and combined heat and energy systems,[149] cannot have outputs higher than 50,000,000 Btu per hour for heating and 2 MW for electric power generation.[150]

[140] 16 U.S.C. § 1600 (3).
[141] *Id*.
[142] 16 U.S.C. § 1600(3) and (5).
[143] 16 U.S.C. §§ 6501 to 6591.
[144] *Id*.
[145] P.L. 133-79.
[146] Farm Security and Rural Investment Act of 2002 § 9011.
[147] P.L. 133-79.§ 9012 (d).
[148] Farm Security and Rural Investment Act of 2002 § 9013 (a) (1) and (2).
[149] Farm Security and Rural Investment Act of 2002 § 9013 (a) (2) (B).
[150] Farm Security and Rural Investment Act of 2002 § 9013 (c).

VERMONT LAWS AND REGULATIONS

Vermont has various laws and regulations related to wood harvesting. The most specific are Vermont's Acceptable Management Practices, which aim to protect water quality. However, there are several other laws aiming to protect forests, which are also briefly described below.

Acceptable Management Practices (AMPs)

The first and most commonly referred rule regarding harvesting operations is the "Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont" (AMPs). Created in 1987, the AMPs are designed to prevent petroleum products, mud, and woody debris or logging slash from being discharged into, and thus negatively impacting the water quality of, Vermont's waters.[151] The AMPs call for specific actions to be taken during and after logging to reduce impacts to water quality,[152] such as keeping logging equipment 25 feet away from streams, and using light thinning or selection harvests in buffer strips. Even though AMPs are not mandatory, a logger or landowner who has complied with the AMP is not liable if a discharge occurs either during or after timber harvesting.[153]

Vermont's AMPs are considered successful at managing water quality violations.[154] This is probably the result of "high level[s] of cooperation and voluntary compliance among loggers to bring their operations into compliance with Vermont's Water Quality Statutes."[155] The Division of Forestry maintains an on-going relationship with the forest industry in Vermont via technical assistance to provide on-site recommendations designed to protect water quality and prevent erosion during and after operations.[156]

Vermont's Land Use and Development Act

Vermont's Land Use and Development Act, also known as Act 250, addresses development of Vermont's landscape.[157] Act 250 requires, among others, a land use permit for any logging operation over 2,500 feet elevation, which is issued by the District Environmental

[151] Vermont Agency of Natural Resources; Division of Forestry (2010).
[152] 12-020 Vt. Code R. § 010.
[153] *Id*.
[154] Vermont Agency of Natural Resources; Division of Forestry *supra* at note 151.
[155] *Id*.
[156] Vermont Agency of Natural Resources; Division of Forestry *supra* at 151.
[157] Vermont Environmental Board (November, 2000).

Commission.[158] The Act also has ten criteria to minimize environmental impacts from developments, including water and air pollution, water supply, and impact on existing water supplies. Soil maintenance is also among the criteria for issuing a permit as development plans must show that the activity "[w]ill not cause unreasonable soil erosion or affect the capacity of the land to hold water so that a dangerous or unhealthy condition may result."[159] Following those criteria, a permit will only be granted if the applicant shows that "the subdivision or development will not result in any reduction in the potential of productive forest soils[160] for commercial forestry; or the development or subdivision will not significantly interfere with or jeopardize the continuation of agriculture or forestry on adjoining lands or reduce their agricultural or forestry potential."[161]

Heavy Cutting Law

Vermont's Heavy Cutting Law regulates the heavy cutting of forest lands.[162] Heavy cutting is defined as harvest that leaves "residual stocking level of acceptable growing stock below the C-line."[163] Any landowner who: (i) intends to start heavy cutting of 40 acres or more, (ii) has conducted heavy cuts on other lands in the past five years within a radius of 1,000 feet of the proposed harvest totalizing 40 acres or more of harvest acreage, or (iii) has conducted heavy cuts on other lands in the past five years within a radius of 2 miles of the proposed harvest over 80 acres, shall file a notice of intent with a department field forester.[164] Landowners who follow forest management plans approved by the Vermont Department of Forests, Parks and Recreation will have the cut exempt from the notice of intent. In addition to the Use Value Appraisal Program standards, the heavy cut must also comply with minimum practice standards, regarding regeneration, even and uneven aged management, among others.[165]

[158] 10 V.S.A. Chapter 151 §§ 6001 and 6081.
[159] 10 V.S.A. Chapter 151 § 6086 (a)(4).
[160] Productive forest soils are define as "soils which are not primarily agricultural soils but which have a reasonable potential for commercial forestry and which have not been developed (…) Land use on those soils may include commercial timber harvesting and specialized forest uses (…)." (10 V.S.A. Chapter 151 §6001 (8)).
[161] 10 V.S.A. Chapter 151 § 6086 (a)(9)(C).
[162] 10 V.S.A. Chapter 83 §2625.
[163] 10 V.S.A. § 2625 (a)(2).
[164] 10 V.S.A. § 2625 (b).
[165] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 1997).

Portable Skidder Bridge Initiative

The Portable Skidder Bridge Initiative is designed to provide loggers, landowners, and foresters with information about portable skidder bridges and their use as temporary structures for crossing streams during logging.[166] Stream crossings are cited as the most common source of discharges to water resources during harvesting operations.[167] These bridges are designed to reduce sedimentation, and channeling and degradation of aquatic habitat during logging operations, even if they comply with prescribed AMPs.[168]

Wetland Rules

Vermont's Wetlands Rules allow logging and other silvicultural activities within wetlands and their buffer zones generally without prior review. However, such activities need to follow a number of guidelines. These guidelines include a general mandate that the activity does not alter the wetland's outlet or flow of water into and out of the wetland.[169] The guidelines also prohibit draining, dredging, filling, and grading, unless the activity is provided for in the Rules' Allowed Uses.[170] Allowed Uses include silvicultural activities that comply with Vermont's AMPs.[171] Additionally, the Wetland Rules require specific measures to protect Class I and II wetlands,[172] which are classified according to their hydrological and ecological significance with respect to flood control, surface and groundwater protection, fish and wildlife habitat, natural heritage, and other criteria.[173] All silvicultural activities occurring within a Class I wetland, buffer zone of a Class I wetland, or in any Class II wetland "specifically designated by the Secretary or Panel to protect habitat for any species on the state or federal list of threatened or endangered species" require a plan, and written approval by the Commissioner of the Department of Forests, Parks and Recreation.[174]

[166] Vermont Agency of Natural Resources; Division of Forestry (*Forest Watershed Program: Portable Skidder Bridge Initiative*).
[167] Vermont Agency of Natural Resources; Department of Forests, Parks & Recreation (*The Vermont Forest Resources Plan 1999-2008: Assessment Report and Key Indicators*), and University of Vermont, School of Natural Resources (March, 1990)
[168] Vermont Agency of Natural Resources; Division of Forestry *supra* at note 166.
[169] Vermont Agency of Natural Resources; Natural Resources Board (2010).
[170] *Id*.
[171] *Id*.
[172] Class I wetlands are generally considered exceptional or irreplaceable to Vermont's natural heritage and merit the highest level of protection, while Class II wetlands are designated by the Secretary of the Agency of Natural Resources or their authorized representative and merit protection based on the criteria described previously (*Id*.).
[173] Vermont Agency of Natural Resources; Natural Resources Board *supra* at note 169.
[174] *Id*.

Silviculture Activities Altering Streams or Rivers

Vermont law requires authorization from the Secretary of the Agency of Natural Resources for any activity, either by movement, fill, or excavation, that changes, alters, or modifies the course, current, or cross section of any watercourse or designated outstanding resource waters within or bordering the state.[175] The permit is only required where the volume of in-stream material is ten cubic yards or more.[176] No authorization will be needed, however, if the activity is related to accepted silvicultural practices as defined by the Commissioner of Forests, Parks, and Recreation.[177]

Storm Water Permits

Beyond logging operations, Vermont uses storm water permits to protect water quality from runoff pollution resulting from construction activities and impervious surfaces. The following permits may not directly relate to logging operations, but could be related to other facilities associated with a woody biomass market, such as pellet or wood chip processing or storage facilities:

- Permit 3-9015, Impervious Surface Permit[178]
- Permit 3-9020, Construction General Permit[179]
- Permit 3-9003, Multi-Sector General Permit[180]
- Discharge Permit[181]

Harvesting activities shall also obtain chip harvesters registration,[182] and must comply with slash removal[183] and timber trespass rules.[184]

[175] 10 V.S.A. § 1021(a).
[176] *Id*.
[177] 10 V.S.A. § 1021(f).
[178] Vermont Agency of Natural Resources; Department of Environmental Conservation (January, 2013).
[179] Vermont Agency of Natural Resources; Department of Environmental Conservation (June, 2012).
[180] Vermont Agency of Natural Resources; Department of Environmental Conservation (October, 2013).
[181] According to Vermont law, a discharge permit from the Agency of Natural Resources Secretary shall be obtained by "any person who intends to discharge waste into the waters of the state or who intends to discharge into an injection well or who intends to discharge into any publicly owned treatment works any waste which interferes with, passes through without treatment, or is otherwise incompatible with that works or would have a substantial adverse effect on that works or on water quality." (10 V.S.A. Chapter § 1263).
[182] 10 V.S.A. Chapter 83 § 2623.
[183] 10 V.S.A. Chapter 83 § 2648.
[184] 13 V.S.A. Chapter 77 §§ 3601 - 3604.

In addition to harvesting legislation, Vermont has enacted a number of general laws that are applicable to woody biomass electric facilities and harvesting activities. The two most relevant laws for the purpose of this report are Vermont's Public Service Board (PSB) Certificate of Public Good and the Use Value Appraisal.

Certificate of Public Good (30 VSA §248)

As stated in 30 VSA §248 (a)(3), electric generation facilities within Vermont need to obtain a Certificate of Public Good (CPG) from the Vermont PSB. To issue the certificate for woody biomass electric facilities, the PSB must find that the facility "compl[ies] with harvesting procedures and procurement standards that ensure long-term health and sustainability."[185] Those generation facilities are also required to annually disclose the amount, type, and source of wood acquired to generate energy.[186] The combination of these provisions forces wood-fired biomass electric facilities to only obtain wood from contractors that adhere to harvesting standards imposed by the PSB,[187] as well as pre-harvest approval from the Vermont Department of Fish and Wildlife.[188] Vermont Agency of Natural Resources participates as a party in the CPG process, usually by providing evidence and recommendations to the PSB, and by signing a Memorandum of Understanding with the developers.[189]

Use Value Appraisal (UVA)

Under Vermont's tax code,[190] forest landowners are entitled to get their land appraised for its "use value" for agriculture or forestry rather than for its highest commercial-development value. This is meant as a way to encourage and assist maintenance and conservation of Vermont's forests.[191] Part of this appraisal is the Vermont's Use Value Appraisal (UVA) program, which promotes sustainable forest management on private lands of at least 25 acres. UVA "enables landowners who practice long-term forest management to have their enrolled land appraised for property taxes based on its value for forestry, rather than its fair market (development) value."[192]

[185] 30 V.S.A. § 248(b)(11)(c).
[186] 30 V.S.A. § 248(p).
[187] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 2000).
[188] *Id*.
[189] 30 V.S.A. § 248(a)(4)(E).
[190] 32 V.S.A. Chapter 124.
[191] 32 V.S.A. § 3751.
[192] Vermont Agency of Natural Resources; Division of Forestry (*Use Value Appraisal*).

If land is enrolled in UVA, a permanent lien attaches to the property and will continue as long as the land is "actively managed."[193] If the forest is improperly harvested or there is a change in land use, the land will be discontinued under the program and will be taxed.[194] The tax is 20 percent of the full fair market value of the changed land.[195]

Use Value Appraisal in Numbers

In 2009, more than 11,000 forest land parcels were enrolled in Vermont's UVA program, totaling 1.5 million acres and 30 percent of all eligible private forest in Vermont. In 2011, 1.8 million acres were reportedly enrolled in the program, providing tax reductions to more than 14,000 landowners.[1] The program is considered "Vermont's most successful forestry and conservation program in its ability to maintain a large percentage of forest lands forested."[2]

[1] North East State Forest Association (Vermont, 2013).
[2] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 2010).

The present list of legislation is not exhaustive and harvesters might also have to comply with specific legislation and plans in place for the region. Examples include: Slash Removal provisions,[196] the Source Protection Plans developed to protect public drinking water supplies;[197] Total Maximum Daily Load (TMDL), if the waterways where the activity is developed is listed as "impaired" under the Clean Water Act; [198] Vermont's Wildlife Action Plan which prescribes actions to conserve particular species;[199] and Vermont's Forest Resource Plan,[200] in addition to town zoning regulations and ordinances.[201] Examples of voluntary initiatives to protect Vermont's forests can also be found across the state, including: (i) the Forest Legacy Program, which aims to protect environmentally important forest that are threatened by conversion to non-forest uses;[202] (ii) the non-profit Logger Education to Advance Professionalism (LEAP), which improve education, professionalism, and perception of the logging industry in Vermont;[203] and (iii) Vermont Monitoring Cooperative, which monitors forest ecosystem health in Vermont.[204]

[193] *Id*.
[194] *Id*.
[195] 32 V.S.A. § 3757(a).
[196] 10 V.S.A Chapter 83 § 2648.
[197] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 2010).
[198] *Id*.
[199] Vermont Agency of Natural Resources, Department of Fish and Wildlife (November, 2005).
[200] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation *supra* at note 197.
[201] *Id*.
[202] 16 U.S.C.§ 2103c.
[203] Logger Education to Advance Professionalism (2010).
[204] Vermont Monitoring Cooperative.

Vermont Department of Forests, Parks, and Recreation also assists private forest landowners "with the writing of forest management plans, control of invasive plants, and with work on improving the function/drainage of forest road systems to reduce environmental impacts" under its Environmental Quality Incentive Program.[205]

[205] Vermont Agency of Natural Resources; Division of Forestry (*Stewardship*).

SECTION III: GAPS

As described in Section I, there are a number of environmental impacts that woody biomass harvesting can have on forests, in particular water and soil quality, biodiversity and wildlife habitat, and carbon emission and storage. As seen in Section II, there are several national and local laws and regulations with which Vermont harvesters need to comply while harvesting. One remaining question, however, is whether the existing legislation addresses the specific issues related to harvesting for woody biomass. Despite federal and state efforts to balance forests' multiple uses and harmonize present and future interests, this report advocates for the need to develop additional instruments that address specific forestry concerns related to woody biomass harvesting, in particular biomass harvesting guidelines, procurement standards, and certification process.

BIOMASS HARVESTING GUIDELINES

The Vermont legislature has already acknowledged the need for guidelines that address specific environmental impacts related to biomass harvesting. In 2013, Vermont enacted Act 24, which requires the Commissioner of Forests, Parks, and Recreation to develop "voluntary harvesting guidelines that may be used by private landowners to help ensure long-term forest health and sustainability."[206] If harvesting is to occur on state lands, the Commissioner shall ensure that the harvesting is consistent with the purposes of the guidelines, which is long-term forest health and sustainability.[207]

> "By focusing on the health of the forest, the productive capacity of the soil, water and air, maintenance of biodiversity of the flora and fauna and the interaction and relationship between all those systems, we can sustain our working forest landscape and the services they provide."
>
> Source: Vermont's Agency of Natural Resources; Department of Forests, Parks and Recreation (June, 2010).

As a result, in January, 2015 the Department of Forests, Parks and Recreation adopted a set of voluntary harvesting guidelines for private landowners.[208] As explained in the document, the goals of the guidelines is to guide private landowners to make good "decisions and actions when planning and conducting harvesting operations. These recommended practices, or educational

[206] Act 24 Section 3 (a) (2).
[207] 10 V.S.A. § 2750(b).
[208] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (January, 2015).

tools, are intended to be voluntary."[209] The harvesting guidelines was developed having many purposes in mind, and cover five different areas: (i) preparation and conduction of the harvesting; (ii) water resources; (iii) protection of soil health and productivity; (iv) biodiversity and wildlife habitat; and (v) planning for change.

Despite this essential step towards the adoption of harvesting guidelines, it is important to note that they are not primarily biomass harvesting guidelines. Even though several of the environmental impacts addressed in Section I are present in many harvesting activities, harvesting for energy can have a greater environmental impact because it might involve removing larger volumes of materials and removing materials on a shorter rotation than conventional pulpwood and saw timber harvesting. Thus, harvesting for energy particularities need to be taken deeply into consideration. To address all of the specific concerns mentioned before, this report encourages the development of guidelines to address harvesting woody biomass concerns in order to fill the gaps currently present in Vermont's legislation, as many other states have already done.[210]

A number of studies already address the need for biomass harvesting guidelines in the state. One of the main studies was developed by the Forest Guild Biomass Working Group and released in 2010. Entitled "Forest Biomass Retention and Harvesting Guidelines for the Northeast,"[211] the Forest Guild's study provides a forest management guideline based on excellent forestry. The goal of the guidelines is to "maintain the functions, structures, and composition that support the health of the entire forest ecosystem."[212] The recommendations are divided in six sections - rare forest and species, soil fertility, wildlife and biodiversity, water quality and riparian zones, harvesting and operations, and carbon storage – and are summarized in Appendix A.

Besides the Forest Guild, several other organizations, such as the Manomet Center for Conservation Sciences,[213] and the Sustainable Forestry Initiative,[214] as well as states that have already adopted biomass harvesting guidelines, like Maine, [215] New Hampshire, [216]

[209] *Id*.
[210] Examples include Maine, Minnesota, Missouri, and Pennsylvania.
[211] Forest Guild Biomass Working Group (May, 2010).
[212] *Id*.
[213] Manomet Center for Conservation Sciences (June, 2010).
[214] Sustainable Forest Initiative (January, 2010).
[215] Maine Agricultural and Forest Experiment Station, University of Maine (January, 2010)
[216] The Good Forestry in the Granite State Steering Committee, University of New Hampshire (2010).

Pennsylvania,[217] Michigan, [218] California, [219] Minnesota, [220] South Carolina,[221] and Wisconsin,[222] provide great guidance for Vermont's development of such guidelines. Even though the guidelines may vary and particularities of each forest need to be considered case-by-case, there are a number of recommendations that are often seen in those guidelines. Regarding soil, for example, many guidelines include recommendations such as: (i) avoid removing topsoil, forest floor, roots and stumps; (ii) avoid whole-tree harvesting; and (iii) the adoption of low-impact harvesting techniques, such as careful trail layout, directional felling, maintain a permanent skid trail, to name a few.

Special attention must be given to whole-tree harvesting,[223] usually adopted by biomass harvesting activities. As explained by the Vermont Public Service Board (PSB), whole-tree harvesting "can reduce woody material left on the forest floor when compare to more traditional harvesting guidelines."[224] In order words, whole-tree harvesting can remove up to 96 percent of aboveground biomass, reducing stand structural elements and soil organic matter, and disrupting soil nutrient cycle.[225] To overcome some of these issues, in the Memorandum of Understanding (MoU) signed between the Agency of Natural Resources (ANR) and North Springfield Sustainable Energy Project (NSSEP) specific retention standards were agreed to be implemented for whole-tree harvesting:[226]

For a Harvest of:	**Drop and leave a minimum of:**
Less than 50% basal area	2 trees > 14" diameter at breast height("DBH") per acre, 4 trees > 6" DBH per acre
More than 50% basal area	4 trees > 14" DBH per acre, or 6 trees > 6" DBH per acre

[217] Pennsylvania Department of Conservation and Natural Resources (2008).
[218] Michigan Department of Natural Resources and Environment (May, 2010).
[219] California Department of Forestry and Fire Protection Resource Management (January, 2013).
[220] Minnesota Forest Resources Council (December, 2007).
[221] South Carolina Forestry Commission (December, 2012).
[222] Wisconsin Department of Natural Resources; Wisconsin Council of Forestry (2008).
[223] Whole-tree harvesting refers to the use of "highly mechanized high-capacity equipment, and results in the extraction of the entire aboveground portion of the tree, including trunk, branches, and needles or leaves from the forest. The practice of whole-tree harvesting was developed as means of extracting much higher yields per unit area from forest through the removal of biomass that, under other harvesting methods, would have remained on site to decompose… [W]hole-tree is harvesting can effectively remove up to 96% of aboveground biomass" (Vermont Public Service Board (February, 2014)).
[224] Vermont Public Service Board (February, 2014).
[225] *Id*.
[226] Vermont Public Service Board (June, 2013).

PROCUREMENT STANDARDS

In addition to biomass harvesting guidelines, the adoption of procurement standards can also be a useful tool to ensure forest management and sustainability. While the harvesting guidelines are designed to be followed by harvesters, procurement standards are designed to ensure consumers that suppliers are providing a final product which protects and improves forest health. This tool is much needed in commodities, such as woody biomass, which have multiple changes in ownership throughout its supply chain.[227] Procurement standards also provide the general public with adequate resource protection and predictability for the permitting of proposed biomass users.[228] Similar to the harvesting guidelines, Vermont's Commissioner of Forests, Parks, and Recreation is currently developing procurement standards, which shall be mandatory to "all state agencies and departments in procuring wood products from whole-tree harvests in Vermont,"[229] and will include specifications on the retention of live and dead trees.[230]

The Biomass Energy Development Working Group (Working Group), put together by the Vermont Legislature, issued recommendations for woody biomass procurement standards in its Final Report.[231] The Working Group also reached specific conclusions, in particular: (i) that the adoption of a uniform state procurement standard for maintaining forest health to be incorporated into existing permitting regulations, like Act 250,[232] would offer more predictability in the permitting process;[233] (ii) that there is no need to adopt at this point separate procurement standards for different facilities or consumers, even though in the future specific standards for suppliers, distributors, and consumers could be developed;[234] and (iii) procurement standards

[227] Environmental Defense Fund (July 2, 2012).
[228] Vermont Legislative Council, Biomass Energy Development Working Group Final Report (Jan. 17, 2012).
[229] 10 V.S.A. § 2750(c).
[230] *Id.*
[231] Vermont Legislative Council; Biomass Energy Development Working Group (January, 2012).
[232] *Id.*
[233] *Id.*
[234] *Id.*

should require biomass electricity generating facilities to provide for a design system efficiency of at least fifty percent over the course of a full year.[235] The Working Group also suggests creating contracts with suppliers so they know their responsibilities to consumers.[236]

Despite the non-existence of general procurement standards, Vermont has developed them on a case-by-case basis. The two in-state wood-fired biomass electric power plants adopted procurement standards, which was required as part of the Certificate of Public Good (CPG) process. McNeil Station, for example, has to follow "wood procurement and storage plan that provides control of [its] wood on site."[237] The McNeil power plant procurement standards include: protecting aesthetic quality near hiking trails, following accepted soil erosion control practices, promoting healthy growth in forests, and protecting wildlife habitat, endangered species, wetlands and streams.[238] Additionally, professional foresters monitor all of McNeil Biomass Station's harvests, which are approved by a Vermont Department of Fish and Wildlife biologist and must comply with guidelines for forest management.[239]

The proposed facility in Springfield also agreed on procurement standards, which would have been mandatory if the plant was approved. The "harvest performance standards" were part of the MoU entered into between NSSEP and the ANR.[240] Some of the harvest standards agreed upon included: (i) to follow recognized silvicultural practices, like those offered by the U.S. Forest Service, as well as those for Vermont lands; (ii) to retain downed woody material that exists prior to harvesting; (iii) to adopt harvest plans for retention where whole-tree harvesting occurs; (iv) to implement Vermont's AMPs; (v) to not be detriment the soil quality; (vi) to not use more than 12 percent of the harvesting area for roads; and (vii) to adopt specific agreements on issues such as wildlife and invasive species.[241]

Several other examples of procurement standards initiatives can be found around the state. The study *Harnessing the Power of Local Wood Energy*,[242] for instance, proposes a set of criteria which help schools and communities utilizing wood-fired energy systems to procure wood in accordance with ecological, economic, and social values. Focusing on Mount Abraham High

[235] *Id.*
[236] *Id.*
[237] Burlington Electric Department (*Joseph C. McNeil Generating Station).*
[238] *Id.*
[239] *Id.*
[240] Vermont Public Service Board (June, 2013).
[241] *Id.*
[242] Caitlin Cusack (2008).

School's woodchip heating system, the study suggests that schools and communities prefer wood procured from harvesters who comply with laws, including Vermont's AMPs, who use a professional forester to design the road and plan the harvest, who adopt long-term management plans, and who certify their lands through forest management certification systems.[243]

The Vermont Family Forests' Biomass Assessment Team also developed a report for Middlebury College.[244] The report divides its recommended procurement standards into three categories: general guidelines, access guidelines, and vegetation management guidelines.[245] The general guidelines include creating an approved forest management plan and map; using well-maintained equipment; maintaining proper buffers for special habitats; and maintaining forest aesthetics.[246] The access guidelines include fully compliance with AMPs; use of equipment that exerts the lowest possible ground pressure; non-exposure of mineral soil; identification of trails, roads, and landings on easily compacted soils; and minimization of the number and extent of truck roads.[247] Finally, the vegetation management guidelines encompass management practices, such as:

- the avoidance of clear cutting of patches larger than two acres;
- retention of cavity and/or snag trees, and down trees;
- growth of largest trees and adoption of longer rotations;
- prioritization of native species;
- allowance of natural regeneration;
- limit tree-felling to slopes of 60 percent or less, and limit mechanical harvesting to slopes of 30 percent or less;
- retention of all materials that are less than 4 inches in diameter on site; mark of all trees prior to the removal; and
- adoption of cutting cycles between 10 and 15 years.[248]

Regional and state groups have also worked on providing general principles of sustainability to guide the development of procurement standards. Such groups, like the Northern Forest Land's

[243] *Id.*
[244] Vermont Family Forests (January, 2004).
[245] *Id.*
[246] *Id.*
[247] *Id.*
[248] *Id.*

Council and the Vermont Forest Resources Advisory Council, establish principles for soil and water quality, the balance of forest age classes, conservation of habitats, perpetuation of wood supply for biomass fuels, and the promotion of forest recreation.[249]

CERTIFICATION

One of the main concerns regarding the effectiveness of procurement standards is the certification process. As explained by the Working Group, some kind of program that monitors and evaluates harvesting practices should be in place, especially from an independent source.[250] Certification works with procurement standards; certification ensures that "forests are managed in a sustainable manner and that trees are harvested with environmentally sound practices,"[251] while procurement standards ensure consumers that suppliers are conforming to those guidelines.[252]

There are three different means of obtaining certification commonly used: through self-reporting, second-party verification, or third-party verification.[253] First, self-reporting is when the producer monitors and reports about his/her own harvesting or manufacturing process.[254] Examples of this already take place in Vermont for renewable electric generation and for wastewater systems.[255] Second-Party Verification is when a buyer verifies that a supplier, or the products of a supplier, conforms to a certain standard.[256] The City of Burlington Electric Department adopts this verification process for the McNeil Biomass Station through a certified forester.[257] Third-Party Verification is when an independent third party verifies that a supplier, or its products, conforms to a certain standard and is considered to provide the most assurance that a standard is met.[258] The independent party can be governmental or nongovernmental.[259]

[249] *Id.*
[250] Vermont Legislative Council; Biomass Energy Development Working Group *supra* at 231.
[251] Vermont Tree Farm Program.
[252] Vermont Legislative Council; Biomass Energy Development Working Group *supra* at 231.
[253] *Id.*
[254] *Id.*
[255] *Id.*
[256] *Id.*
[257] *Id.*
[258] *Id.*
[259] *Id.*

There are two major forest management certification organizations that provide frameworks for ensuring sustainable forest management and chain of custody (CoC) third-party certification: the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC). The SFI standard is the only North American forestry standard.[260] The program promotes responsible forest management, tracks and certifies chain of custody, and provides a labeling service so purchasers can make responsible purchasing choices.[261] SFI's standards for the promotion on sustainable forest management include 14 core principles,[262] 20 objectives, 38 performance measures, and 115 indicators, which are all developed by professional foresters, conservationists, scientists, and others.[263] While SFI's standard is not a mandated procurement standard, it certainly serves as a voluntary standard, and it is a great example for what procurement standards could be.

FSC's certification processes is structurally similar to SFI's, with most differences reflected at the performance level.[264] For example, both forest management certifications require updates to the overall management plan and to the calculation of harvest levels; however, FSC requires updates to both every ten years, whereas SFI calls for annual documentation for management plans and periodic updates to calculations of harvest levels with no mandated timeframes.[265] Functionally, one of the more significant differences is that the U.S. Green Building Council, which manages the Leadership in Energy and Environmental Design (LEED) standard, provides credit for FSC certified wood only.[266] SFI certified wood is not prohibited from LEED buildings, but those materials do not receive credit in the LEED certification process.[267]

Several states already use both FSC and SFI systems of forest certification. Michigan's forest certification process, for instance, involved soliciting bids for third party assistance in developing a forest certification system with additional contracting for pre-assessment scoping, forest

[260] Sustainable Forestry Initiative (*Basics of SFI*).
[261] *Id*.
[262] SFI's 14 principles of sustainability are: sustainable forestry, forest productivity and health, protection of water resources, protection of biological diversity, aesthetics and recreation, protection of special sites, responsible fiber sourcing practices in North America, avoidance of controversial sources (including illegal logging in offshore fiber sourcing), avoidance of controversial sources, legal compliance, research, training and education, public involvement, transparency, and continual improvement (Sustainable Forest Initiative *supra* at 214).
[263] *Id*.
[264] Kathryn Fernholz *et al* (March, 2011).
[265] *Id*.
[266] *Id*.
[267] *Id*.

certification, and subsequent audits.[268] The organization that received the contract developed a forest certification program that met both SFI and FSC standards.[269] Michigan also reviews its forest management annually, looking at both contractor's audit reports and in-house staff assessments to ensure its standards are promoting sustainable forestry.[270] The dual certification process allows Michigan to reap benefits of socially, economically, and environmentally managed forests, and avoids any pitfalls resulting from perceptions of one certification organization over the other. Alternatively, Maine provides information on FSC, SFI, the Master Logger Certification program, and the American Tree Farm System with no emphasis or endorsement of any particular certification program.[271]

The American Farm Tree System (AFTS) is another example of third-party certification program in Vermont. The AFTS's standards of sustainability for certification aim to promote sustainable forest management, encourage adaptive management, compliance with laws, protecting air, water, and soil quality and biodiversity, among others.[272] AFTS's advantage is that it has a chapter for Vermont, which is managed by Vermont Woodland Association.

Another mechanism, which is becoming more common and could be easily adopted in states where the majority of forestland is in private ownership, like Vermont, is group certification. "Simply defined, group certification is a method whereby one business entity can certify multiple properties under multiple ownerships." [273] The main difference from individual certification is that in group certification the entity holds the certificate not the forest owner. [274] Group certification offers a quicker and cheaper tool for small properties to certify their land. [275]

[268] Michigan Department of Natural Resources.
[269] *Id*.
[270] *Id*.
[271] Maine Department of Agriculture, Conservation and Forestry.
[272] American Tree Farm System (September, 2011).
[273] Ben Larson *et al* (November, 2012).
[274] *Id*.
[275] *Id*.

SECTION IV: REGIONAL STANDARDS

The final question refers to the need for regional agreements on common standards. As mentioned in the previous sections, Vermont has a number of laws and regulations that need to be followed by those promoting harvesting activities. However, biomass harvesting guidelines, procurement standards, and certification procedures should be adopted in order to protect Vermont's forests from the increased demand of energy from woody biomass. But even if Vermont adopts such tools, are its forests protected under a regional biomass market? To address this final question, two steps must be taken. The first step is to understand the need for regional standards; the second is to determine what regional mechanisms would best meet the goals of Northeast states.

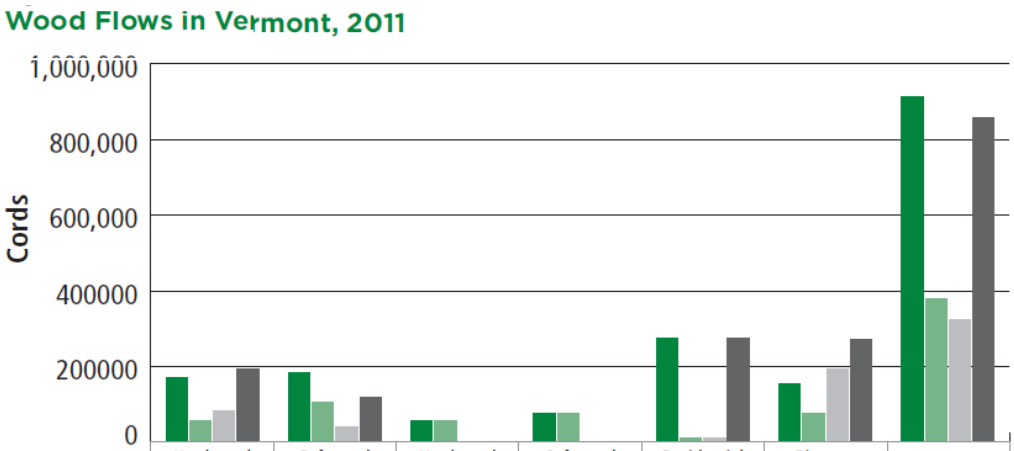
REGIONAL BIOMASS MARKET

> "Not all the timber harvested in Vermont stays here to be processed in Vermont. Likewise, not all of the wood processed in the state is harvested in Vermont. Wood flows freely in the regional economy."
>
> Source: North East State Foresters Association (Vermont, 2013).

Forests are part of a larger landscape; "many forestry issues are regional in nature and do not recognize political boundaries."[276] Several examples can be found around the U.S. to help illustrate this fact. Besides national parks located in more than one state, there are a number of other interstate natural resources. The Connecticut River Valley, for instance, is located across four New England states: New Hampshire, Vermont, Massachusetts, and Connecticut. Considered "one of the most at-risk areas of New England for forest fragmentation,"[277] activities developed in one part of the Connecticut River Valley have great potential to negatively affect the quality of the whole natural source. Lake Champlain, which is partly located in Vermont, provides an even greater problem because it is not only an interstate resource, but a truly multi-national resource which passes the Canadian border.[278]

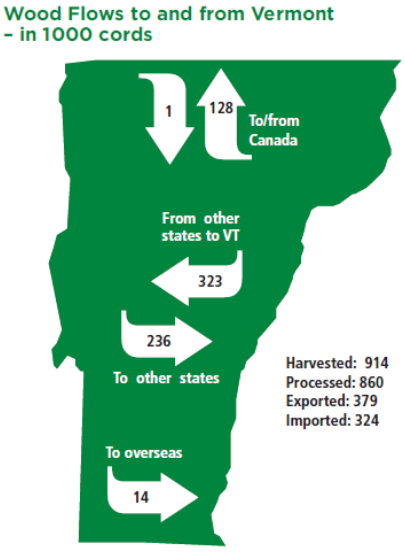
Another major issue is related to the free flow of goods between the Northeast states, in particular wood. As simply explained by the Vermont Department of Forests, Parks and Recreation, "Vermont is part of a larger regional economy within which wood flows freely." [279] Vermont has two wood-fired biomass electric facilities which, besides using the wood harvested in-state forests, also procure woody biomass from neighboring states. The McNeil power plant alone imports almost 130,000 green tons per year from other areas, mainly New York and Quebec. [280] Vermont also exports part of the wood harvested in-state. [281] The wood flows numbers for 2011 are presented below, according to North East State Foresters Association:[282]

[276] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation (June, 2010).
[277] *Id*.
[278] *Id*.
[279] North East State Foresters Association (Vermont, 2013).
[280] Nell Campbell and Anna Mika (March, 2009).
[281] North East State Foresters Association *supra* at note 279.
[282] *Id*.



	Hardwood Sawlogs	Softwood Sawlogs	Hardwood Pulpwood	Softwood Pulpwood	Residential Firewood	Biomass Chips	Totals
Harvested	168,932	183,944	56,656	74,903	275,000	154,662	914,097
Exported	56,518	103,690	56,656	74,903	10,000	77,331	379,098
Imported	82,494	39,546	0	0	10,000	191,970	324,010
Processed	194,908	119,800	0	0	275,000	270,000	859,708

As these numbers show, a significant amount of biomass chips, hardwood and softwood, which can be used for electric generation, are being exported to other states. While Vermont imported 191,970 cords of biomass chips in 2011, the state also exported a significant amount in the same year: 77,331 cords.[283] In 2011, of the 914,000 cords harvested in Vermont, 860,000 cords were processed in-state, 379,000 cords were exported, and another 324,000 cords imported. [284]



Source: North East State Foresters Association (Vermont, 2013).

Most of the wood exported goes to nearby states. In 2011, Maine imported as much as 132,990 cords of biomass chips, and another 190 cords of residential firewood/pellets.[285] For the same year, New Hampshire imported 390,677 cords of biomass chips, and 100 cords of residential firewood/pellets.[286] Compared to these states, New York imported less woody biomass in 2011: 9,000 cords of biomass chips.[287]

[283] *Id.*
[284] *Id.*
[285] North East State Foresters Association (Maine, 2013).
[286] North East State Foresters Association (New Hampshire, 2013).
[287] North East State Foresters Association (New York, 2013).

With a potential increase in the demand for woody biomass, these numbers are expected to grow, creating a truly regional market for this energy commodity. The Northeastern region already has in place a number of electric facilities that use woody biomass as their primary fuel. Even though Vermont only has two facilities currently in operation, Maine, New Hampshire, Connecticut, Massachusetts and New York together have over 50 facilities operational or under construction.[288] Two of the neighboring states of Vermont - New Hampshire and New York – have together over 20 wood-fired biomass power plants. And just like Vermont's facilities, several of them procure woody biomass from outside their state.

One example is New Hampshire's Burgess Biopower plant. Located in the City of Berlin, the biomass facility started its operation in the end of 2013. The Burgess facility is a 75MW power plant, estimated to consume up to 750,000 tons of wood per year.[289] While most of the wood is expected to come from New Hampshire's forest, the company recognizes that some of the supply will come from up to 200 mile radius of Berlin.[290] Vermont's closest county, Essex, is just 135 miles away. The brief Burgess BioPower Report on Sustainability released on May 6, 2014 states that in the year of 2013, a total of 80,208 tons of wood was consumed by the facility. The source came from chips (74.5 percent), grinding (20 percent), and bark (5.5 percent). Roughly 4,250 tons (5.3 percent) of the wood came from Vermont.[291] The plant is now qualified to generate Renewable Energy Credits (RECs) for compliance with four states' Renewable Portfolio Standards (RPS) programs: Connecticut, New Hampshire, Maine, and Rhode Island. [292] The expectation is that the plant will generate as many as 591,300 RECs per year.[293]

Another example is the Northern Wood Power Station, a 50 MW wood-fired biomass generation facility located in Portsmouth, New Hampshire. The facility uses wood chips and low-grade wood materials to fuel the plant. In its first five years of generation the power plant consumed more than 2.5 million tons of wood.[294] The plant is less than 150 miles away from Vermont's

[288] Biomass Magazine (July, 2014).
[289] J.P. De Fusco (April, 2012).
[290] The Berlin Daily Sun (April, 2013).
[291] Burgess BioPower, LLC (May, 2014).
[292] Biomass Magazine (May, 2014).
[293] Platts (May, 2014).
[294] New Hampshire Public Service (January, 2012).

borders. The Stratton 48MW wood-fired biomass power plant, located in Maine, is less than 120 miles from Vermont's borders. [295]

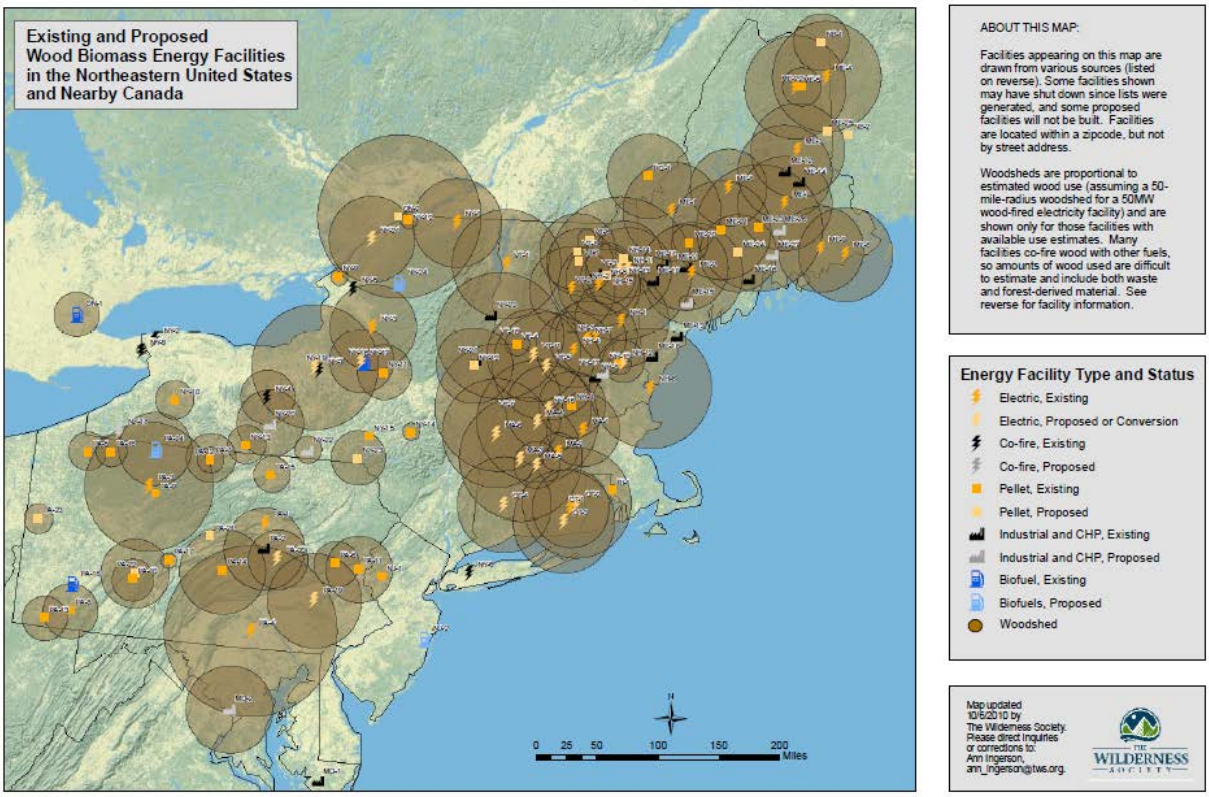
Aware of the impacts nearby states have on Vermont's forests, Biomass Energy Resource Center (BERC) released a 24 counties study to assess Vermont's wood supply in 2007. The study area included all of Vermont's counties, plus additional New York, Massachusetts, and New Hampshire counties where "woodchips and low-grade wood tend to flow in either direction across the state's borders." [296] The 24 counties considered in the study are presented in the image to the right.

According to BERC's study, in 2007 there were six wood-fired biomass power plants in the area considered - two in Vermont and four in New Hampshire (Bridgewater Power, Power and Light, Pine Tree Power, and Hemphill Power)[297] - and together, these power plants consumed approximately 1,481,000 green tons per year. [298] Besides these six power plants, the study also identified other four biomass power plants that were not within the area of study but have an impact on it. The approximate wood fuel consumption of those four power plants was estimated to be 1.18 million green tons per year, and the power plants were located in four different states: Massachusetts (Pine Tree Power), New Hampshire (PSNH Schiller Station), New York (Kenetech Energy System), and Maine (Boralex Stratton Energy Inc.). [299]

The Wilderness Society developed a map to visualize the potential problem where the expected wood supply areas overlap. In the map, the conservation group presumes that the woodsheds "are proportional to the estimated wood use," [300] meaning that for a 50 MW wood-fired biomass electric facility a 50 mile radius is considered the facility woodshed. [301] The result for existing

[295] ReEnergy Holdings, LLC.
[296] Biomass Energy Resource Center (June, 2007).
[297] *Id.*
[298] *Id.*
[299] *Id.*
[300] The Wilderness Society (June, 2010).
[301] *Id.*

and proposed woody biomass energy facilities according to 2010 data is presented in the map below: [302]



The existence of a regional biomass market deserves attention from legislators and regulatory agencies trying to address sustainability issues. Vermont's proximity to states that have operational wood-fired biomass electric facilities, or under construction, shows a potential for possible leakage if forestry concerns are not properly addressed. Leakage impacts can be described in several different contexts. The term is usually defined as the unanticipated decrease or increase in benefits outside of the project or initiative's accounting boundary.[303] Here, leakage means that even if Vermont has laws and regulations in place that properly address forestry issues related to harvesting for woody biomass, Vermont's forests still might not be protected if other states have not established sustainable standards. This is especially true among the Northeastern states where wood flows freely.[304] Without any federal guidance addressing the

[302] *Id.*
[303] As a reference please see Intergovernmental Panel on Climate Change (2000).
[304] North East State Foresters Association *supra* at note 279.

issue, there is a strong need for an agreement among the states which Vermont usually exports its wood for energy use. The Vermont Public Service Department concluded in their 2013 Total Energy Study:

> The fifth policy set the Department identified for analysis takes as its starting point the notion that policies adopted at the regional level or coordinated with our neighboring states may be more effective than policies adopted by a single state. It also reflects understanding that the six New England states are served by an electric grid with a single regional operator and markets, and that biomass is commonly used in a state different from the state in which it is harvested.[305]

[305] Vermont Public Service Department (December, 2013).

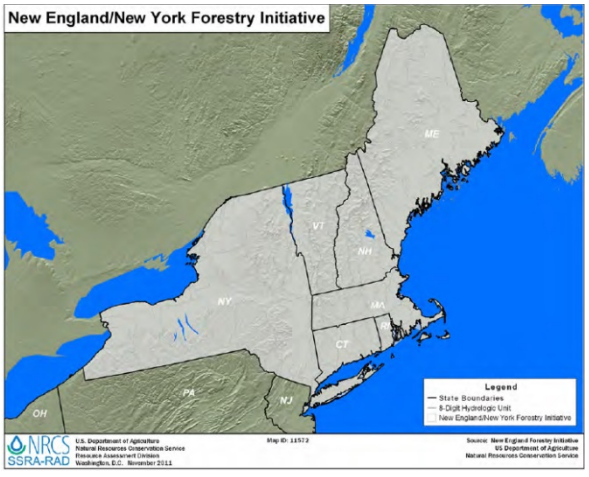
REGIONAL AGREEMENTS IN PLACE

The idea of reaching regional agreements to address regional pressure is not new. In fact, several initiatives and agreements have been made in past decades among Northeastern states. The Vermont Department of Forest, Parks and Recreation, for instance, has been involved in a number of interstate projects, ranging from forestry health efforts, such as the North American Maple and Spruce Budworm control projects and ecological mapping, to participation in the four states[306] economic development activities through the North East State Foresters Association.[307]

> "The New England states' long history of working collaboratively on complex energy and environmental matters will be valuable as we move forward together on renewable resource development, so will our historic working relationship with our neighboring Canadian Provinces on energy and trade issues. As our nation addresses the climate challenge in the coming decade, it will make sense to expand our level of cooperation on energy development and trade, particularly with respect to accelerated commercialization of the vast amounts of on and off-shore renewable resources in the Northeast and in Eastern Canada."
>
> Source: New England Governors' Conference (September 15, 2009).

Another regional initiative is the New England Governor's Conference (NEGC), a regional policy development and implementation organization. Since 1908, the New England Governors meet to address the needs to protect the land and water resources of the region, among other issues, under the NEGC umbrella. Several regional action plans have been adopted through the NEGC, including the Mercury and Acid Rain Action Plans and the 2001 Climate Change Action Plan.[308]

The NEGC has also established a New England/New York Forest Initiative to help prevent the loss of forestland and ensure its sustainability.[309] The Initiative is expected to be part of the New England Land Conservation Act to be introduced to Congress, serving as a national model for regional landscape



[306] Maine, New Hampshire, Vermont, and New York.
[307] Vermont Agency of Natural Resources; Department of Forests, Parks, and Recreation *supra* at note 276.
[308] New England Governors' Conference (*Action Plans, Policy Reports and other Publications*).
[309] New England Governors' Conference (September, 2009).

conservation. [310] Members of the initiative are working to develop the initiative and implement pilot demonstration projects across the states.[311] In 2012, the NEGC also enacted a Resolution directing the New England State Committee on Electricity (NESCOE) to implement a work plan for the Competitive Coordinated Procurement of Regional Renewable Power.[312]

Another important Northeastern initiative is the Northeast and Mid - Atlantic Regional Greenhouse Gas Initiative (RGGI). The RGGI is a cooperative effort between nine Northeastern and Mid-Atlantic states - Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont - to reduce GHG emissions in the region.[313] The RGGI was the first regional agreement to combat climate change signed in the U.S. and establishes a CO_2 Budget Trading Program in an effort to reduce carbon emissions.[314] The agreement establishes a regional annual CO_2 emissions cap of 66.8 million short tons in 2015, which shall decline 2.5 percent each year up to 56.2 short tons in 2020. For 2015, Vermont cap is established at 476,482 short tons.[315] Each state is responsible for creating its own regulatory program, using the Updated Model Rule,[316] to trade carbon allowances. Plants that fall under the RGGI scheme, generating capacity of 25 megawatts or more,[317] may get allowances from any state participating in RGGI and may use those allowances to show compliance with an individual state's program.[318]

[310] *Id.*
[311] New England Governors' Conference, Inc. (July, 2010).
[312] New England Governors' Conference, Inc., Resolution 205 (2012): A Resolution directing the New England State Committee on Electricity (NESCOE) to implement a work plan for the competitive coordinated procurement of regional renewable power.
[313] Regional Greenhouse Gas Initiative (*Welcome*).
[314] Regional Greenhouse Gas Initiative (December, 2005).
[315] Regional Greenhouse Gas Initiative (March, 2014).
[316] "The Model Rule is a set of proposed regulations that form the basis for each RGGI State's CO_2 Budget Trading Program" (Regional Greenhouse Gas Initiative (2013)).
[317] Vermont Agency of Natural Resources; Air Quality & Climate Division (January, 2014).
[318] *Id.*

EXAMPLES IN THE EUROPEAN UNION AND CANADA

Similar to the Northeastern region, other areas of the world have faced analogous regional challenges while dealing with forest health and the increased demand for woody biomass for energy generation. In particular, European Union (EU) countries and Canada, which have been promoting the use of woody biomass for energy generation for many decades. Solid biomass, for example, accounts for approximately 47 percent of renewable energy use and 67 percent of bioenergy use in the EU, constituting the main source of renewable energy in the area.[319]

The EU provides a good model to be followed by Northeastern states. The EU addresses regional sustainability concerns through the enactment of Directives which establish minimum standards to be implemented by all EU member countries. These minimum standards seek to comply with EU goals towards renewable energy deployment and GHG emission reductions. For years those sustainable criteria were designed just for biofuels, excluding solid and gaseous biomass sources.[320] Among the sustainable criteria established by the EU for liquid biofuels are GHG savings and lands where biofuels sources should not be produced, such as lands with high biodiversity value, or with high carbon stock (e.g. wetlands). [321]

As of 2007, the EU has deployed efforts to develop biomass sustainability criteria and certification schemes.[322] The European Commission released in 2010 a report on voluntary sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling,[323] and the EU Committee for Standardization is currently undergoing development of standards for solid biofuel regulation.[324] Also, since 2001, the EU has had an RPS program.[325] Under the EU's RPS, biomass conversion technologies shall have an efficiency of at least 85 percent for residential and commercial applications, and 70 percent for industrial applications.[326]

Additionally, EU countries have been involved in efforts to develop specific sustainability requirements for biomass in addition to the requirements set at the minimum level by the EU at

[319] Institute for European Environmental Policy (July, 2011).
[320] European Commission (2012).
[321] Directive 2009/28/EC.
[322] Biomass Technology Group (February, 2008).
[323] European Commission (February, 2010).
[324] Biomass Energy Centre (*Standards*).
[325] Trent Berry & Matt Jaccard (2001).
[326] Directive 2009/30/EC Article 13 (6).

an international and national scale. The United Kingdom (UK) and Netherlands, for instance, are coordinating to develop sustainability requirements for biomass.[327] "The aim of this cooperation is to harmonize scheme design, reduce administration for business and demonstrate how such systems could be developed on an EU-wide basis."[328] This lends support for the principle that regional agreements can be effective, especially when working under overarching directives from the EU to establish sustainability requirements that are uniform across countries. Germany and Belgium have also provided some input to this initiative.[329]

Besides this multi-national effort, countries have developed nation-wide standards. Among some of the countries are: UK, with its Renewable Transport Fuel Obligation,[330] and Renewable Heat Initiative (RHI); [331] Netherlands' Biomass Action Plan [332] and Testing Framework for Sustainable Biomass, [333] with nine basic principles of sustainability criteria for biomass, including minimal requirements and reporting obligations;[334] and Belgium's regional agreements which include the Action Plan for Renewable Electricity, Action Plan for Renewable Heating and Cooling, [335] and certification systems in place at the regions of Brussels, Flanders, and Wallonia.[336]

Outside the EU, Canada has a long woody biomass history. Unlike the EU, however, Canada has little regulation at the national level. Without clear sustainability standards for biomass harvesting at the national level, each province is left to design its own sustainable standards. Many of the provinces have established voluntary standards for sustainable biomass harvesting or incorporated biomass harvesting into their forest management acts.[337] Although all of the Canadian provinces address biomass in some form (whether it be a guideline or a requirement), regulation of biomass is by no means uniform across the provinces.[338] Among the provinces that have adopted better sustainability standards of woody biomass for energy use are British Columbia, Nova Scotia, and New Brunswick.

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[327] Jinke Van Dam *et al* (2008).
[328] *Id*.
[329] *Id*.
[330] *Id*.
[331] Erin Voegele (March, 2013).
[332] Biomass Action Plan (BAP) Driver (January, 2009).
[333] Biomass Technology Group *supra* at note 322.
[334] Jinke Van Dam *et al supra* at note 327.
[335] Biomass Action Plan (BAP) Driver *supra* at note 332.
[336] Jinke Van Dam *et al supra* at note 327.
[337] Wood Pellet Association of Canada (November, 2013).
[338] World Wildlife Fund (February, 2010).

For all the reasons pointed out in this report, the EU management of biomass sets a good model to be followed by setting minimum standards that should be followed by regions that are connected through ecosystems and biomass markets, as the U.S. Northeast. The adoption of minimum, uniform standards in the regional level would ensure that woody biomass is harvested sustainably and remains a truly renewable resource. This approach is effective because it sets out minimum standards for renewable energy use that must be followed by all signatory states, yet still allows for state flexibility in establishing their own renewable energy standards as they see fit.

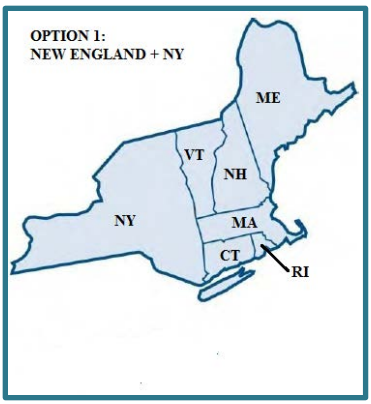
For more information about EU Directives regarding biomass, and specific countries and Canadian Provinces' initiatives to regulate woody biomass sustainability see Appendix B.

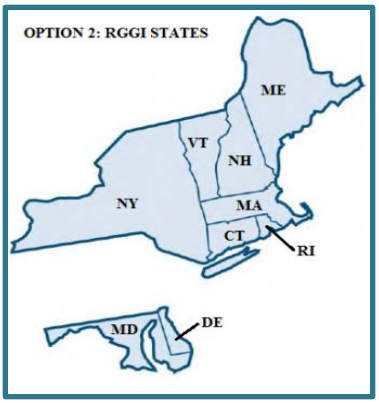
THE PATH FORWARD

In conclusion, *Vermont should seek a regional agreement to ensure the sustainability of woody biomass sources*. As explained by the Biomass Energy Resource Center (BERC),

> Congressional and state leaders from the region would provide a valuable service by inspiring thoughtful planning and policy development to support wise use of the Northern Forest biomass resource in anticipation of pressure to shift away from fossil fuel to renewable energy both within the region and nationwide.[339]

However, before addressing the options that could be adopted by the Northeastern states to best ensure environmental sustainability while using woody biomass for energy, the participant states must be determined. The first suggested approach would be to engage all New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) plus New York. This approach would ensure that all states where Vermont's wood flows freely are included in the agreement. Further, these seven states also have RPS programs or voluntary renewable goals in place, making it easier to incentivize the adoption of common standards for renewable energy biomass facilities that are eligible for RECs or equivalent, as explained in the following subsection. A second approach would be to pursue an agreement with all the RGGI member states. This approach would include the seven states already mentioned, plus Delaware and Maryland. This approach is also recommended since sustainability standards for the development of woody biomass are intrinsically related to improving forest health and productivity, which in turn results in lower carbon emissions and greater carbon storage. Therefore, it would also make sense that states committed to reduce GHG emissions also compromise on minimum standards that would result in higher efficiency level for woody biomass energy technologies and better forest management.





[339] Biomass Energy Resource Center *supra* at note 296.

Renewable Portfolio Standards and Equivalent

One important approach that could be implemented by Northeastern states is the adoption of a regional definition of woody biomass for state RPS programs, or equivalent.[340] RPSs are mandates for retail electric suppliers to supply a minimum percentage of or amount of their retail load with eligible sources of renewable energy, such as wind, solar, biomass, and hydro.[341] As explained by Mendonca *et al*,

> RPS policies initially developed in the mid-1990s in response to the perceived dangers of the introduction of electricity restructuring, where regulators privatized and liberalized many state electricity markets, and its possible effects on market competition. Since renewable energy sources were not at that time price competitive with a market that did not include the full social costs of electricity, it was agreed that additional policies were required to monetize their positive benefits. [342]

Several types of compliance enforcement mechanisms can be adopted to ensure that RPS goals are met by the states. A typical mechanism, adopted by all the Northeastern states' RPS programs, is the use of trading Renewable Energy Credits (RECs),[343] which also help improve the financial feasibility of non-fossil fuel projects. Simply explained RECs are tradable commodities that "authenticate that 1MWh of electricity was generated from qualifying renewable resource." [344] In New England, RECs are tracked through New England Power Pool's (NEPOOL) Generation Information System (GIS). Therefore, electric retail suppliers with enough registered RECs in the NEPOOL GIS at the end of a one year period are able to prove their compliance with RPS mandates.

Woody biomass is considered a qualifying renewable resource under all of the RPS programs in the U.S., generating usually one REC for each MWh produced. However, the specifics of the eligible woody biomass vary greatly among the different RPS programs, with some states not providing further guidance on how to ensure the sustainability aspects of the wood to be used, while others regulate the adoption of forest management practices, minimum efficiency, and

[340] As stated before, Vermont does not have in place a RPS in place, but rather renewable energy goals. However, the suggestions could be applied for Vermont's current SPEED program, the proposed Renewable Energy Standard and Energy Transformation Program (House Bill 40) or Vermont Public Service Department's Total Renewable Energy and Efficiency Standard (TREES) suggestion (Vermont Public Service Department (December, 2014)). .
[341] Miguel Mendonca, David Jacobs, and Benjamin Sovacool (October, 2009).
[342] *Id*.
[343] Ernest Orlando Lawrence Berkeley National Laboratory (April, 2007).
[344] Miguel Mendonca, David Jacobs, and Benjamin Sovacool *supra* at note 341.

emission levels. The same is also applicable to Vermont, which establishes minimum criteria for woody biomass power plants to qualify under its Sustainably Priced Energy Enterprise Development (SPEED) program. The following subsection will analyze the eligible woody biomass sources under Vermont's SPEED program and the other five New England states' RPS. It will also analyze how eligible woody biomass sources are defined under New York, Delaware, and Maryland's RPS programs following the previous suggestions that agreements should include nearby states and/or RGGI member states.

- VERMONT

Among the states here analyzed Vermont is the only state which did not have a mandatory RPS in place as of 2014. Instead, Vermont established voluntary goals for retail electric providers, who "shall [not] sell or otherwise provide or offer to sell or provide electricity in the state of Vermont without ownership of sufficient energy produced by renewable resources."[345] The "sufficient" amount of renewables was determined to be the amount "of energy equal to [the retail electricity provider's] total incremental energy growth between January 1, 2005 and January 1, 2012."[346]

To ensure that this voluntary goal is met Vermont created two programs. The first is the renewable energy pricing mechanism, which allows an electric utility to implement renewable energy pricing program for its customers. This pricing mechanism can be done through tariffs, standard special contracts, or other arrangements to "increase the company's reliance on, or the customer support of, renewable sources of energy or the type and quantity of renewable energy resources available."[347] The second is the SPEED program.[348] The goal of the SPEED program is the development of renewable sources in Vermont, providing a somewhat

SPEED BIOMASS OPERATING PROJECTS

As reported by the Vermont SPEED's webpage, only three biomass projects are operating under the SPEED program: Cersosimo Lumber Biomass, RPC Power and McNeil New Renewable. Those projects have an estimated MWh output per year of 5,957; 2,978; and 144,475, respectively.

Source: VermontSPEED.com/project-status

[345] 30 V.S.A. § 8004(a).
[346] 30 V.S.A. § 8004(b). Instead of, or in addition to, this requirement, a retail electricity provider may pay into the Vermont clean energy fund (30 V.S.A. § 8004(e)).
[347] 30 V.S.A. §8003 (a).
[348] 30 V.S.A. § 8005.

predictable and stable return on the investment for a determined time.[349]

Woody biomass units are eligible for both programs. However, only renewable wood, meaning wood that "is being consumed at a harvest rate at or below its natural regeneration rate,"[350] is considered an eligible renewable resource. Besides renewability, to be qualified for the SPEED program woody biomass units shall also have "a design system efficiency (the sum of full load design thermal output and electric output divided by heat input) of at least 50 percent."[351] The unit must also seek a Certificate of Public Good from the Vermont Public Service Board (PSB) which, as mentioned previously, will require compliance with the Clean Air Act regarding emissions of pollutants, adoption of efficient designs, annual disclosure of the amount, type, and source of wood used, and compliance with harvesting guidelines and procurement standards.[352] As explained by the Vermont PSB, the adoption of such requirements helps ensure that "in-state woody biomass generation facilities will employ current, regionally consistent best practices that will promote long-term forest health while not unnecessarily increasing the cost of RPS compliance."[353]

In January 21, 2015 a new Bill was introduced in Vermont's House of Representatives.[354] The Bill aims to repeal the SPEED program and create the Renewable Energy Standard and Energy Transformation (RESET) program. The RESET would function in a similar fashion to traditional RPS programs. Woody biomass generation units are qualified renewable energy facilities under the RESET program, regarding the facility uses wood sources that are "consumed at a harvest rate at or below its natural regeneration rate."[355] To be qualified under the distributed renewable generation class, the biomass facility shall also "produce[ ] both electricity and thermal energy from the same biomass fuel and the majority of the energy recovered from the plant is thermal

[349] It should be noted that since Vermont did not have an RPS as of 2014, it was generally the policy of Vermont utilities to separate the RECs from these projects and sell the RECs into neighboring state's RPS programs. The utility then used the REC revenue to offset customer rates.
[350] 30 V.S.A. § 8002 (17).
[351] 30 V.S.A. § 8005a (n).
[352] 30 V.S.A. § 248(p).
[353] Vermont Public Service Board (January, 2013).
[354] H. 40, available at http://legislature.vermont.gov/assets/Documents/2016/Docs/BILLS/H-0040/H-0040_As_Introduced.pdf (last accessed on January 30, 2015). The Bill was introduced by Representatives Tony Klein and Rebecca Ellis.
[355] Proposed amendment to 30 VSA § 8002 (17).

energy"; [356] and comply with harvesting and procurement standards, as adopted by the Commissioner of Forests, Parks, and Recreation.[357]

- CONNECTICUT

Connecticut's RPS is promulgated under Conn. Gen. Stat. §16-245a, and it includes sustainable biomass facility among Class I Renewable Energy sources.[358] To be qualified for RECs under Connecticut's RPS the biomass facility shall have

> [A]n average emission rate of equal to or less than .075 pounds of nitrogen oxides per million Btu of heat input for the previous calendar quarter, except that energy derived from a sustainable biomass facility with a capacity of less than five hundred kilowatts that began construction before July 1, 2003, may be considered a Class I renewable energy source.[359]

Besides the facility requirement, only biomass that is cultivated and harvested in a sustainable manner will qualified under Connecticut Class I RECs.[360] Even though the statute does not provide guidelines for what considers "harvested in a sustainable manner", it does provide examples of sources that are not considered sustainable biomass, including construction and demolition waste, finished biomass products from sawmills, paper mills or stud mills, or biomass from old growth timber stands.[361]

- DELAWARE

Delaware's RPS establishes that only the "electricity generated from the combustion of biomass that has been cultivated and harvested in a sustainable manner as determined by [the Delaware Department of Natural Resources and Environmental Conservation] DNREC" [362] will be qualified as an eligible source under the state's RPS. As expressly stated under the Delaware Code, energy produced in a waste-to-energy facility or incinerator is not included in that definition.[363] DNREC has promulgated regulations specific to electricity generated from the

[356] Proposed amendment to 30 VSA § 8005 (c)(1).
[357] Proposed amendment to 30 VSA § 8005 (c)(2).
[358] Conn. Gen. Stat. §16-1(a)(26).
[359] *Id*.
[360] Conn. Gen. Stat. §16-1(a)(45).
[361] Some exceptions are applicable to this sources, such if the energy derived from the biomass is subject to a long-term power purchase agreement (Conn. Gen. Stat. §16-1(a)(45)).
[362] DEL. CODE tit. 26, § 352(6)(h).
[363] DEL. CODE tit. 26, § 352(6)(f).

combustion of biomass,[364] providing further information of what should be considered sustainable biomass. Title 7 of Delaware Administrative Code, for example, defines biomass as "organic matter that is available on a renewable or recurring basis."[365]

The DNREC regulations also require energy crops and agricultural residues used as fuel in combustion facilities to meet the standards of the U.S. Department of Agriculture (USDA)'s National Organic Program or follow a list of management practices that minimize herbicide and pesticide use and promote soil and water conservation.[366] For timber, forestry and timber residues, the combustion facility needs to implement a conservation and management plan which shall cover:

- A non-point source pollution management program to prevent erosion, control flood water, and conserve soil for harvesting, road construction, and all other mechanical disturbances;
- Best Management Practices as identified by the state and local forestry services;
- Minimization of waste associated with harvesting and on-site processing operations;
- Rates of harvest that do not exceed levels which can be permanently sustained;
- Safeguards that identify and protect rare and state and federally-designated threatened and endangered species and their habitats (e.g., nesting and feeding areas);
- Forest regeneration that enhances ecosystem diversity;
- Use of environmentally friendly non-chemical methods of pest management and limited use of pesticides;
- Use of environmentally friendly non-chemical methods of weed management and limited use of herbicides;
- Use of exotic species that is carefully controlled and actively monitored to avoid adverse ecological impacts;
- Avoidance of forest conversion to plantations or non-forest land uses, except circumstances where: a very limited portion of the forest management unit will be impacted; forest lands are of low ecological value; and conversion will improve ecological value; and
- Exclusion of old-growth timber (from a tree that is 150 years old or older).[367]

[364] 7-100-106 DEL. ADMIN. CODE § 1.0 *et seq*.
[365] 7-100-106 DEL. ADMIN. CODE § 3.0
[366] 7-100-106 DEL. ADMIN. CODE § 5.2.
[367] 7-100-106 DEL. ADMIN. CODE § 5.3.

- MAINE

Under Maine's RPS program woody biomass – simply defined as wood or wood waste – generators are considered an eligible renewable resources if total power production capacity does not exceed 100 MW.[368] Apart from the capacity limit and vintage rules (units need to start operation after September 1, 2005), Maine Public Utility Commission does not provide any other specifics about eligible woody biomass sources.[369] In fact the Maine Public Utility Commission has explicitly decided not to do so, as explained in a decision regarding RPS eligibility certification:

> The Commission concluded that, without further legislative direction and in light of the unqualified statutory term biomass, the Commission would adopt a relatively broad definition that includes all fuel derived from wood and wood byproducts.[370]

- MARYLAND

Maryland's RPS was enacted trough COMAR title 20 Chapter 61 §01 *et seq*. However, the definition of eligible renewable source is provided in Md. Public Utility Companies Code §7-701. This Statute includes "qualifying biomass" as eligible renewable source for Maryland's RPS.[371] The Statute generally defines "qualifying biomass" as "nonhazardous, organic material that is available on a renewable or recurring basis."[372] Among the wood sources explicitly permitted are: (i) waste material from mill residue, precommercial soft wood thinning, slash, brush, and yard waste, pallet, crate, or dunnage, silvicultural sources (tree crops, by products, and residues;[373] or (ii) a plant cultivated exclusively for being used as an eligible renewable source.[374] The statute expressly excluded from the definition of "qualifying biomass" waste material derived from old growth timber, [375] sawdust or wood shaving, [376] unsegregated solid waste or postconsumer wastepaper, and invasive exotic plant species.[377] Old-growth timber is defined as timber from a

[368] Title 35-A Me. Rev. Stat. Chapter 32, § 3210 (2)(C)(2)(g)(1999).
[369] CMR 65-407-311 (2007).
[370] Maine Public Commission Utility Order Granting New Renewable Resource Certification to Lincoln Paper and Tissue, LLC (Docket No. 2008-17, January 27, 2009).
[371] MD. CODE ANN., PUB. UTIL. § 7-701(r)(3).
[372] MD. CODE ANN., PUB. UTIL. § 7-701(l)(1).
[373] MD. CODE ANN., PUB. UTIL. § 7-701(l)(1)(i).
[374] MD. CODE ANN., PUB. UTIL. § 7-701(l)(1)(ii).
[375] MD. CODE ANN., PUB. UTIL. § 7-701(l)(1)(i)(1).
[376] MD. CODE ANN., PUB. UTIL. § 7-701(l)(1)(i)(1)(A).
[377] MD. CODE ANN., PUB. UTIL. § 7-701(l)(3).

forest "at least 5 acres in size with a preponderance of old trees, of which the oldest exceed at least half the projected maximum attainable age for the species."[378] To be recognized as an old-growth forest, the forest must also exhibit several additional characteristics, such as shade tolerant species, randomly distributed canopy gaps, high degree of structural diversity, and accumulation of varying dead wood.[379]

- MASSACHUSETTS

Massachusetts' RPS offers an interesting case. Although biomass has been included since the enactment of Massachusetts' RPS program, its definition and requirements have changed over time, particularly after the release of the Manomet study in 2010.[380] Currently, under Massachusetts' RPS only "low emission advanced biomass power conversion technologies using fuels such as wood, [..] energy crops, [and] biogas,"[381] are considered eligible renewable energy sources.[382-383] At the end of 2010, the Massachusetts Department of Energy Resources (DOER) enacted a regulation setting a number of rules governing the operation of biomass conversion generation units.[384] These rules vary from emission limitation and efficiency level to adoption of forestry plans.

The DOER regulation starts by providing the definition of several terms not previously defined in Massachusetts' RPS.[385] For example, the regulation provides an extensive list of eligible biomass woody fuel sources, which is divided in five major groups: forest derived residues,[386] forest derived thinnings,[387] forest salvage,[388] non-forest derived residues,[389] and dedicated energy crops.[390]

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[378] MD. CODE ANN., PUB. UTIL§ 7-701(g)(1).
[379] MD. CODE ANN., PUB. UTIL § 7-701(g)(2).
[380] Manomet Center for Conservation Sciences (June, 2010).
[381] M.G.L. Chapter 25A §11F(b)(8).
[382] *Id*.
[383] The definition of liquid biofuel expressly excludes biomass woody fuel as a possible source (225 CMR 14.02 (2010)).
[384] 225 CMR 14.00 (2010).
[385] *Id*.
[386] Forest Derived Residues: (1)Tops, crooks and other portions of trees produced as a byproduct during the normal course of harvesting material, such as timber, pulpwood or cordwood; (2) Other woody vegetation that interferes with regeneration or the natural growth of the forest, limited to locally invasive native species and non-native invasive woody vegetation.
[387] Forest Derived Thinnings: (1) Unacceptable growing stock which is defined as trees considered structurally weak or have low vigor and do not have the potential to eventually yield a 12 foot sawlog or survive for at least the next 10 years; (2) Trees removed during thinning operations, the purpose of which is to reduce stand density and enhance diameter growth and volume of the residual stand.
[388] Forest Salvage: damaged, dying or dead trees removed due to injurious agents, such as wind or ice storms or the spread of invasive epidemic forest pathogens, insects and diseases or other epidemic biological risks to the forest, but not removed due to

The DOER regulations also provide a number of requirements that biomass conversion units must comply with to be qualified as a Class 1 Renewable Generation Unit. Additionally, the units must show that, over a 20 years period, the life cycle emissions were reduced by at least 50 percent when compared to combined cycle natural gas electric generating facilities using the most efficient commercially available technology and, if applicable, the fossil fuel-fired thermal energy unit being displaced.[391] Regarding thermal energy, the GHG emission reductions are compared with the gas-fired thermal unit using the most efficient commercially available technology. [392]

Furthermore, the owner, operator, or agent of a generation unit that uses eligible biomass woody fuel or manufactured biomass fuel,[393] shall provide a Biomass Unit Annual Compliance Report, with overall efficiency and GHG analysis,[394] and documentation of the tonnage input. The generation unit shall also originate, procure, and transact Biomass Fuel Certificates,[395] which will follow the fuel.[396]

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competition. Such eligible trees may be removed without limitation for biomass fuel, only if a major threat to forest health or risk to private or public resources, and if the USDA Animal Health and Plant Inspection Service (APHIS), the USDA Forest Service, or appropriate federal or state governmental agency has issued a declaration, rule, or order declaring a major threat to forest health or risk to private or public resources. Forest Salvage also includes trees removed to reduce fire hazard within Fire-adapted Forest Ecosystems, as certified by a letter to the Department from the state agency responsible for forestry in consultation with the appropriate environmental state agencies.

[389] Non-forest Derived Residues: (1) Primary forest products industry: Lumber mill residues or lumber processing residues consisting of the slabs, shavings, trimmings, sawdust, bark, end pieces of wood, and log cores that result from the various processing operations occurring in sawmills, pulp mills, and veneer and plywood plants;(2) Secondary forest products industry: Wood waste produced as a byproduct of the production of finished wood products, including but not limited to clean residues from woodworking shops, furniture factories, and truss and pallet manufacturing; (3) Land use change – non-agricultural: Trees cut or otherwise removed in the process of converting forest land to non-forest and non-agricultural uses provided that such development has already received all applicable state and local permits for the development; (4) Land use change – agricultural: Trees cut or otherwise removed in the process of converting forest land to agricultural usage, either for new or restored farm land; (5) Yard waste: Leaves, grass clippings, prunings, and other natural organic matter discarded from yards and gardens; (6) Wood waste: Non-treated pallets; pruned branches, stumps, and whole trees removed during the normal course of maintenance of public or private roads, highways, driveways, utility lines, rights of way, and parks.

[390] Dedicated Energy Crops: Wood purposefully grown for the purpose of producing fuel, provided that such wood was not grown on land that sequestered significant amounts of carbon, such as a forest, and provided that such land does not have the economic potential to support production of any other agricultural crop grown for human consumption as food.

[391] 225 CMR 14.05 (1)(a)(7) (2010).

[392] *Id*.

[393] 225 CMR 14.05 (8)(a) (2010).

[394] 225 CMR 14.05 (8)(d) (2010).

[395] Biomass Fuel Certificates will follow specific rules depending of the wood source. For example, for forest derived residues and derived thinnings, the certificate shall comply with the Eligible Forest Biomass Tonnage Report, which cites the adoption of a long-term management cutting plan developed by a licensed forester, the host state forest agency authorized cutting plan, or the signature of a professional forester (225 CMR 14.05 (8)(a)(3) (2010)). These same biomass sources shall certify that only the allowable percentage of total weight removal was in indeed harvested, and that the forest sustainability thresholds were followed. On the other hand, for non-forest derived residue fuel, forest salvage, and dedicated energy crops, the certificate "shall be completed by the fuel supplier and certified by the Owner, Operator, or Authorized Agent duly verifying the fuel supplier, tonnage, source, and that said material feedstock meets the criteria of an Eligible Biomass Woody Fuel as provided in the Biomass Eligibility and Certificate Guideline" (225 CMR 14.05 (8)(a)(6) (2010)).

[396] 225 CMR 14.05 (8) (2010).

The regulations also establish a number of verification tools. For example, an Advisory Panel shall meet twice a year to evaluate the effectiveness of the woody biomass provisions, especially the tracking and enforcement of the eligible biomass woody fuel and the Biomass Fuel Certificates.[397] Additionally, every five years a Forest Impact Assessment shall be developed by the DOER with the purpose to assess the impacts from biomass fuel removals on Massachusetts and regional forests, and the "appropriateness and accuracy of greenhouse gas accounting."[398] Biomass units shall also provide on, a quarterly basis, information about the overall efficiency of the system, and their Renewable Energy Attributes, which will be calculated as follow:[399]

MWh	**Overall Efficiency**	**Renewable Energy Attribute**
01	≥ 60%	1 REC Class 1
01	> 50% but < 60%	0.5+5 x (Overall Efficiency – 0.5)
01	50%	0.5 REC Class I

Similar calculations are found for Advancement of Biomass Conversion Generation Units,[400] with the difference that minimum overall efficiency is established at 40 percent, and the calculation for Renewable Energy Attributes from units that have overall efficiency in a quarter between 40 and 60 percent is 0.5+2.5x(Overall Efficiency – 0.4).[401]

As demonstrated, Massachusetts has adopted the most detailed rules regarding woody biomass. Many applauded Massachusetts' progressive policy for "rewarding good biomass," [402] as opposed to producing a carbon debt from woody biomass.[403] The Vermont PSB, for instance, already proposed following the efficiency requirements adopted by Massachusetts' DOER since

[397] 225 CMR 14.05 (8)(b)(1) (2010).
[398] 225 CMR 14.05 (8)(b)(2) (2010).
[399] 225 CMR 14.05 (8)(c)(1) and (3) (2010), respectively.
[400] Advancement of biomass conversion generation unit is the generation unit which "utiliz[es] a new energy conversion technology or process[es] the woody biomass fuel in a new manner, but in no instance shall the Unit use a single cycle stream turbine generator." The section moves on to explain that "[t]he unit shall be amongst the first installed Generation Units, and demonstrate advancement in the commercial applicability, including advancements in the control and reduction of emissions other than greenhouse gas emission, of biomass energy." (225 CMR 14.02 (2010)).
[401] 225 CMR 14.05 (8)(c)(4) (2010).
[402] Natural Resources Defense Council (May, 2012).
[403] *Id*.

it "inherently protects the forest resource by requiring less woody biomass fuel to be harvested per unit of energy; and...[it] assists in the regulation of air pollution,"[404] rewarding for increasing levels of efficiency.[405]

However, Massachusetts' approach has also been criticized for closing the doors to new woody biomass plants. This is because, while Massachusetts' RPS does not exclude woody biomass, the high standards imposed on biomass units discourage much of its use due to the low value of biomass energy supply. [406] Additionally the standards practically prohibit biomass electricity generation units in the state "because neither proposed nor existing facilities can meet these efficiency standards without incorporating additional technology that converts heat waste into useful thermal energy."[407]

- NEW HAMPSHIRE

New Hampshire's RPS was enacted in 2007.[408] Among the eligible renewable sources is "eligible biomass technologies,"[409] defined as "generating technologies that use biomass fuels as their primary fuel,"[410] or 90 percent of the total energy input, and it has:

> [A] quarterly average nitrogen oxide (NOx) emission rate of less than or equal to 0.075 pounds/million British thermal units (lbs/MmBtu), and either has an average particulate emission rate of less than or equal to 0.02 lbs/MmBtu as measured and verified under RSA 362-F:12 or is participating in a plan approved by the department under RSA 362-F:11, IV for reductions in particulate matter emissions from other emission sources comparable to the difference between the generation unit's particulate matter emissions rate and the 0.02 lbs/MmBtu rate.[411]

Under New Hampshire's RPS "biomass fuels" are defined as "plant-derived fuel including clean and untreated wood such as brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips or pellets, shavings, sawdust and slash, […] biogas, or liquid biofuels,"[412] excluded any

[404] Vermont Public Service Board *supra* at note 353.
[405] *Id*.
[406] Sarah M. Hayter (2013).
[407] *Id*.
[408] RSA Section 362-F.
[409] RSA Section 362-F:4 (f).
[410] RSA Section 362-F:2 (VIII).
[411] *Id*.
[412] RSA Section 362-F:2 (II).

materials from construction or demolition debris.[413] Besides the definition and emission limits, New Hampshire's RPS also provides an unique rule which allows "useful thermal energy" to be accounted under the program, which will be expanded on later in this report.[414]

- NEW YORK

New York's RPS was adopted by the state's Public Service Commission (PSC) in 2004.[415] Biomass is included as one of the renewable resources eligible under the program.[416] Further clarification about the eligible biomass sources is provided in PSC Case Order 03-E-0188 (2004) Appendix B, which enumerates valid biomass sources as follow:

- Agricultural residues, such as remaining wood after crops harvesting;
- Harvested wood;
- Mill residue wood, including sawdust;
- Pallet waste;
- Refused derived wood;
- Site conversion waste wood;
- Silvicultural waste wood, ;
- Sustainable yield wood, or energy crops; and
- Urban waste wood.

Of this list, harvested wood and silvicultural waste wood have a set of requirements to ensure forest protection. In both cases the biomass facility owner has to comply with a Forest Management Plan, which shall include sustainable forest management practices that address biological diversity conservation, and promote forests' productive capacity and ecosystem health. In these cases the biomass supplier shall also prepare a harvest plan. [417] The harvest plan will include, among other issues, locations of all streams, wetlands and water bodies, anticipated volume of wood to be harvested, and silvicultural best management practices. The harvesting operations will also be inspected periodically by state authorities or non-governmental forest certification bodies, in particular the Forest Stewardship Council (FSC), the Sustainable Forestry

[413] *Id*.
[414] RSA Section 362-F:4 (I).
[415] New York PSC Case Order 03-E-0188 (2004).
[416] New York PSC Case Order 03-E-0188 Section II (B) (2004).
[417] New York PSC Case Order 03-E-0188 Appendix B (2005).

Initiative (SFI), and the American Farm Tree System (AFTS).[418] As pointed out by New York PSC,

> [T]he eligibility standards we are adopting contain appropriate requirements that ensure the eligibility of a biomass feedstock consisting of harvested wood or silvicultural waste wood is conditioned on that use not adversely affecting long-term forest resource. Also, any tree harvesting operations must be performed in a manner that protects or improves forest productivity and conserves and protects biological diversity, soil and water resources and rare and endangered species.[419]

- RHODE ISLAND

Electricity produced using "eligible biomass fuel" is considered a renewable energy resource under Rhode Island's RPS, if the unit is in compliance with air permits.[420] Eligible biomass fuel includes various forms of woody biomass, specifically "brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips, shavings, slash and other clean wood that is not mixed with other solid wastes, [and] energy crops.[421] Rhode Island Public Utilities Commission (PUC) extends the definition of eligible biomass fuel to also include "yard trimmings, site clearing waste, [and] wood packaging."[422] Rhode Island PUC also clarifies that other wood sources can be considered eligible under the RPS program if the applicant demonstrates that the wood source proposed is clean wood. [423] Rhode Island PUC regulation also specifies the procedure for the certification of eligible biomass fuel generation units, including the need to submit a fuel source plan in order to demonstrate that the fuel use is an eligible biomass fuel. The fuel source plan shall include, among others, the type of fuel is going to be used, and description of the measures to be taken to ensure that only eligible biomass fuel is used. [424]

[418] *Id*.
[419] New York PSC Case Order 03-E-0188 (2004).
[420] R.I. GEN. LAWS § 39-26-5(a)(6).
[421] R.I. GEN. LAWS § 39-26-2(6).
[422] 90-060-015 R.I. CODE R. § 3.7.
[423] *Id*.
[424] 90-060-015 R.I. CODE R. § 6.9 (i).

Table 1. Summarized wood sources under RGGI state members' RPS and Vermont's SPEED program.

State	RPS' Biomass Definition	Sustainable Language	Sources Expressly Included	Sources Expressly Excluded
Connecticut	Sustainable Biomass Facility	Cultivate and harvested in a sustainable manner		- Construction and demolition waste - Finished biomass products from sawmills, paper mill, stud mills - Old growth timber stands
Delaware	Organic matter available on a renewable or recurring basis	Cultivate and harvested in a sustainable manner		- Waste to Energy - Incinerator - Old growth timber (150 years old or older)
Maine	Biomass generators fueled by wood or wood waste			
Maryland	Qualifying biomass	Nonhazardous organic material available on a renewable or recurring basis	- Waste material from mill residue, pre-commercial soft wood thinning, slash, brush, and yard waste - Pallet, crate, or dunnage - Silvicultural sources -Energy crops	- Waste material derived from old growth timber - Sawdust or wood shaving - Unsegregated solid waste or postconsumer wastepaper - Invasive exotic plant species.
Massachusetts	Low emission advanced biomass power conversion technology		- Forest Derived Residues (FDR) - Forest Derived Thinnings (FDT) - Forest Salvage - Non Forest Derived Residues - Dedicated Energy Crops	

New Hampshire	Eligible Biomass Technology		- Clean and untreated wood such as brush, stumps, lumber ends and trimmings - Wood pallets, bark, wood chips or pellets - Shavings, sawdust and slash - Biogas - Liquid biofuel	- Materials from construction or demolition debris
New York	Biomass		- Agricultural residues, such as remaining wood after crops harvesting - Harvested wood - Mill residue wood, including sawdust - Pallet waste - Refused derived wood - Site conversion waste wood - Silvicultural waste wood - Sustainable yield wood, or energy crops - Urban waste wood	
Rhode Island	Eligible Biomass Fuel		- Brush, stumps, lumber ends and trimmings - Wood pallets, bark, wood chips, shavings, slash - Yard trimmings, site clearing waste, and wood packaging - Other clean wood that is not mixed with other solid wastes - Energy crops	
Vermont	Biomass	Consumed at a harvested rate at or below its natural regeneration rate		

Table 2. Summarized efficiency, emission and other requirements for biomass plants under RGGI state members' RPS and Vermont's SPEED program.

State	Efficiency	Specific Emission Requirements	Plans, studies, or reports to be developed.
Connecticut		≤0.075 lbs/ MmBtu of NOx	
Delaware			• Conservation and Management Plan
Maine, Maryland			
Massachusetts	At least 50% for 0.5 REC/MWh Over 60% is 1REC/MWh	Compliance with Massachusetts DOER's guidelines low-emission eligibility criteria	• Fuel Supply Plan • Design and Operation Plan • Lifecycle GHG Emission Analysis • Biomass Unit Annual Compliance Report • Biomass Fuel Certificates • Eligible Forest Biomass Tonnage Report for FDR and FDT • Forest Impact Assessment
New Hampshire		≤0.075 lbs/ MmBTU of NOx ≤0.02 lbs/ MmBTU of PM Specific rules for thermal energy generation	
New York			• Forest Management Plan • Harvest Plan for harvested wood and silvicultural waste
Rhode Island			• Fuel Source Plan
Vermont	At least 50%		• Harvesting procedure • Procurement standards

The adoption of different definitions regarding eligible woody biomass under states' RPS and Vermont's SPEED programs frustrates the development of biomass markets. Given the interstate nature of the biomass market, these differences also frustrate the attempt of specific states to protect the health and productivity of its forests. With nearby states' RPS allowing biomass electric generation units with questionable sustainability to be eligible for RECs and to count towards RPS' compliance, there is incentive for private investors to install wood-fired biomass facilities in states that set lower standards. This situation also creates the potential for landowners to sell their wood to nearby facilities that require lower standards for wood harvesting, creating the possibility of unsustainable wood from Vermont's forests qualifying for RECs under another state RPS program. As the Environmental and Energy Study Initiative concludes, "[w]hat is needed is a universal definition that is flexible and functional and promotes feedstock diversification, ensures access for local and small-scale producers, and encourages improved land stewardship on all productive lands."[425]

A way to overcome this issue is for the New England states and/or the RGGI member states, as previously stated, to develop a uniform definition for woody biomass. The definition should define what woody biomass is and establish minimum sustainability criteria to be followed by wood-fired biomass power plants to be eligible under RPS programs or any other renewable energy program in place. These standards shall seek to ensure that the wood used by biomass plants are sustainability harvested and promote forest health and productivity, following biomass harvesting guidelines and procurement standards. The basic definition should include allowed wood types, in addition to avoided harvesting practices and avoided areas, such as lands with high biodiversity value or high carbon stock. The minimum sustainability criteria should include efficiency level, pollutant emission rates, in particular nitrogen oxides and particulate matter, and the development of compliance reports to ensure that only environmental-friendly wood sources are being used for compliance with RPS or other renewable energy programs.

Appendix C provides a model Memorandum of Understanding for eligible woody biomass sources under states' RPS and Vermont's renewable energy goals to be sought by Vermont and the appropriate states.

[425] Environmental and Energy Study Initiative.

Regional Biomass Harvesting Guidelines and Procurement Standards

A suggested complementary, *a second path to a regional definition of woody biomass under states' RPS programs is the harmonization of biomass harvesting guidelines and procurement standards among the Northeast region*.[426] This approach would further ensure that "biomass is harvested on a long-term sustainable basis,"[427] and that the sustainability criteria for eligible woody biomass under the previous Section are fully implemented.

Regional Biomass Harvesting Guidelines, for example, should promote excellent forestry practices through recommendations that cover, at least, six major sections: forests and species, soil fertility, wildlife and biodiversity, water quality and riparian zones, harvesting and operations, and carbon storage. While developing these recommendations, consideration should be given to the standards proposed by the Forest Guild Biomass Working Group, when developing the *Forest Biomass Retention and Harvesting Guidelines for the Northeast*,[428] to find minimum guidelines that all Northeastern states could follow, despite the specific characteristics of each forest.

A corresponding tool is the adoption of Regional Procurement Standards. In a similar fashion to Regional Biomass Harvesting Guidelines, the procurement standards also seek to ensure that procured woody biomass is harvested in a sustainable way. While usually mandatory for public facilities, regional procurement standards should also be followed by wood-fired biomass power plants that seek to comply with renewable energy goals, or generate RECs for RPS compliance. The regional procurement standards should include an approved forest management plan and map; equipment and harvesting techniques requirements; limitation on allowed constructions in the area; retention and rotation rules; and land limitations (e.g. wetlands). Regional procurement standards should also require compliance standards. However, each state should have the discretion to decide which compliance standard will be allowed within its borders: self-reporting, second-party verification, and third-party verification. Verification through organizations such as the Forest Stewardship Council (FSC), the Sustainable Forestry Initiative (SFI), and the American Farm Tree System (AFTS) are feasible options for Northeastern states.

[426] This follows the action proposed in 2007 Conference of New England Governors and Eastern Canadian Premiers (Conference of New England Governors and Eastern Canadian Premiers (February, 2007)).
[427] Biomass Energy Resource Center *supra* at note 296.
[428] Forest Guild Biomass Working Group (May, 2010).

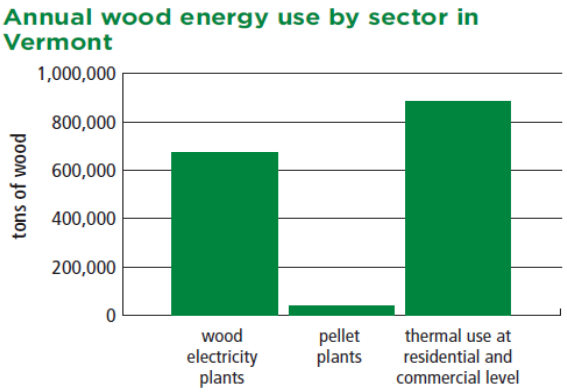
Appendix D provides a model Memorandum of Understanding for biomass harvesting guidelines and procurement standards of woody biomass to be adopted by Northeastern states.

Other Considerations: Transportation and Heating Sectors

Finally, it is worth highlighting that the adoption of a Memorandum of Understanding which uniformly defines eligible woody biomass under renewable energy programs would not automatically address the concerns regarding the use of woody biomass for transportation fuel or heating. To do such, many of the programs would have to be adapted to include transportation and heating in its mandates or voluntary goals.

Harvesting woody biomass for transportation is not seen as economically viable at the moment, but there is potential for it to be in the future. Vermont does not have any biomass biorefinery, but several of the Northeastern states do have such facilities, including New York.[429] In addition, USDA estimates that "2 percent of advanced biofuel production (mostly woody biomass) will come from the Northeast [which] will take 11 biorefineries, producing 40 million gallons per year."[430]

Harvesting for heat also has great impact on forests. In 2010, wood for thermal use was the biggest sector for woody biomass in Vermont, as pointed out by the North East State Foresters Association.[431] While a great part of the wood harvested for thermal use stays within Vermont's boundaries - mostly due to the low value for wood energy which makes it cost prohibitive to ship very far from where it is harvested" [432] – a small amount is exported. In 2010, an estimated 10,000 cords of residential firewood was exported to other regions.[433]



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[429] United States Department of Agriculture (June, 2010).
[430] *Id.*
[431] North East State Foresters Association *supra* at note 279.
[432] *Id.*
[433] *Id.*
[434] *Id.*

Therefore, despite the currently low impact harvesting of woody biomass for transportation and heating has on a regional level, there is a great potential that Vermont's forests will also see future pressure from these two sectors.

In the transportation sector, pressure will mostly come from federal mandates to blend renewable fuels with gasoline under the Renewable Fuel Standards (RFS). EPA is responsible for developing and implementing regulations related to the RFS programs. Following this responsibility, EPA enacted the standards for eligible renewable fuels under RFS[435] "to ensure that only sustainable and environmentally-friendly feedstocks are allowed."[436] The regulation defines renewable fuel as the fuel produced from renewable biomass used to replace or reduce the quantity of transportation fossil fuels, and which has lifecycle GHG emissions at least 50 percent lower than baseline lifecycle GHG emissions.[437] Renewable biomass is further defined as "organic matter that is available on a renewable or recurring basis [and] obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, in an area at risk of wildfire." [438] Other sources, such as plants and crop residue harvested from exiting agricultural land, planted trees and tree residue from a tree plantation located on non-federal land, and slash and pre-commercial thinnings from non-federal forestland that is not ecologically sensitive forestland, are also considered renewable biomass with some additional considerations. [439]

Even though the federal government provides some guidance for transportation fuels, some organizations present critiques of the federal approach regarding biofuels. One valuable critique comes from the Environmental and Energy Study Initiative, a non-profit organization dedicated to promoting environmentally sustainable societies:

> Unfortunately, [the definition of renewable biomass under the RFS] are not so much sustainability safeguards as they are a series of exclusions based on broad ownership and management categories. […] Most woody biomass (except for slash and pre-commercial thinning) is excluded from private, non-industrial forests (NIPFs), even if that land is being sustainably managed. On the other hand, all material is allowed from forest plantations, regardless of how poorly managed they might be. This

[435] 40 C.R.F. 80 subpart M § 80.1401.
[436] Environmental and Energy Study Initiative.
[437] 40 C.R.F. 80 subpart M § 80.1401. For cellulosic biofuel, the lifecycle greenhouse gas emissions are required to be, at least, 60 percent less than the baseline lifecycle greenhouse gas emissions.
[438] *Id.*
[439] *Id.*

> definition will not help improve the sustainability of biomass production. What it will do is lock up enormous quantities of biomass, complicate implementation of the RFS, and retard the development of this renewable energy source. [440]

In the heating sector, pressure will mostly come from residential owners trying to shift from fossil fuel sources and from the development of wood-fired heating systems by commercial and educational facilities. However, firewood "is often harvested discretely and in a diffuse manner that is difficult to properly track."[441] But recently efforts have estimated that firewood accounted for 59 percent of low-grade wood harvested in Vermont, totalizing 752,045 green tons in 2009 for firewood.[442] Despite several attempts to address renewable technology at the federal level, no specific federal policy is currently in place to address this sustainability issue. One way to address such issues at the regional level would be to extend the uniform standards for renewable woody biomass, guidelines, and procurement standards to thermal units through the adoption of Thermal Renewable Energy Credits (TRECs), or equivalent under Vermont's renewable energy goals. While those should be developed in a similar fashion to traditional RECs, specific issues related to system efficiency and pollutant emissions should be taken into account.

Thermal Renewable Energy Credits or Equivalent

One approach to ensure that woody biomass used for thermal energy follows basic standards regarding sustainability is to develop a coherent Thermal Renewable Energy Credits (TRECs), or equivalent under Vermont's renewable energy goals. This approach would benefit the development of woody biomass cogeneration and small scale heating systems, and address sustainability issues regarding wood harvested for those purposes in addition to electricity. Traditionally, thermal energy has been excluded from Vermont's voluntary renewable energy programs and from receiving RECs in states that have RPS programs in place. To date, of the Northeast states only New Hampshire has codified legislation enabling entities to obtain TRECs for useful thermal energy produced.

[440] Environmental and Energy Study Initiative.
[441] Biomass Energy Resource Center *supra* at note 296.
[442] *Id*.

Passed in June 2012, the legislation modified New Hampshire's Electric Renewable Portfolio Standard[443] to add "[u]seful thermal energy" under the definitions section and to classify "renewable energy delivered from class I sources that can be metered… in the form of direct heat, steam, hot water, or other thermal form that is used for heating, cooling, humidity control, process use, or other valid thermal end use energy requirements and for which fuel or electricity would otherwise be consumed."[444] Eligible biomass technologies fall under class I sources,[445] which are those which use "clean and untreated" "[non-]construction and demolition debris" as a primary fuel source.[446] A major qualification for TREC eligibility of class I facilities under the law are nitrogen oxide (NOx) and particulate matter emissions, which are measured in pounds per million British Thermal Units (MmBtu), and varies according to generation technology.[447] Biomass renewable technologies producing thermal energy shall comply with the following requirements:[448]

Gross Heat Input (MmBtu/hour)	**Average Particulate Emission** (lbs/MmBtu)	**Best Management Practices**	**Quartely Average NOx Emission** (lbs/MmBtu)
03 – 30	Less or equal to 0.10		
Higher or equal 30	Less or equal to 0.02		
Less than 100		As determined by the Department of Environmental Services	
Equal or greater than 100			Less or equal to 0.075

[443] RSA Section 362-F.
[444] RSA Section 362-F:2 (XV-a).
[445] RSA Section 362-F:4 (I)(f).
[446] RSA Section 362-F:2 (II) and (VIII).
[447] New Hampshire was first state to officially include thermal energy displacement in a RPS program. The inclusion was passed in 2012, following the recommendations to increase renewable participation in thermal generation presented in the *2009 New Hampshire Climate Action Plan*, developed by the State Department of Environmental Services.
[448] RSA Section 362-F:4 (I) (l).

Each eligible installation is required to meter their thermal output, and one TREC is generated for every 3,412,000 BTUs of useful thermal energy, roughly equivalent to one MWh of electricity.[449] Arguments can be made that this conversion rate does not take into account inefficiencies in various distribution systems leading to less 'useful' thermal energy being used than produced. In smaller systems for home heating, this loss is likely to be in outer shell insulation gaps and interior piping running through unheated basements, which still has the 'useful' purpose of raising indoor temperatures regardless of other losses. In larger systems, such as industrial plants, combined heat and power (CHP) / district heating facilities, and commercial building heating, the metering of 'useful' energy would be more accurate at the end use rather than at the boiler outlet. The regulatory authority in charge of metering practices is the New Hampshire Public Utility Commission.[450]

Another state that is attempting to develop TRECs legislation is Maryland. Introduced to Maryland's House of Representatives on February 5th, 2014 the goal of House Bill 931 (cross-filed with Senate Bill 0530) is to add to the state's RPS certain renewable energy technologies which are used to produce thermal energy. The primary components of the bill are similar to the New Hampshire law, including the 3,412,000 Btu/MWh conversion formula, with a few exceptions such as the definition of old growth timber.[451] Eligible woody biomass is defined in much the same way; however invasive species, unsegregated solid waste or post-consumer wastepaper are excluded,[452] unlike New Hampshire law. On March 11, 2014 the bill received an 'unfavorable' vote of 21 to 2 from the House Economic Matters Committee.[453]

One of the main issues regarding TRECs refers to the monitoring process. However, the day-to-day practical concerns of metering small homeowner systems appears to be a non-issue with solar heating systems, as ten states and the District of Columbia have already allowed them under RPS programs.[454] Applying metering to home heating systems may be addressed at the manufacturing level, and can also be benefited from the utilization of smartgrid technologies to

[449] RSA Section 362-F.:6 (V).
[450] RSA Section 362-F:6.
[451] Maryland's House Bill 931, 7-701 (H).
[452] Maryland's House Bill 931, 7-701 (M)(3).
[453] Maryland House Economic Matters Committee (March, 2014). Some of the issues faced were: (1) thermal energy added to current RPS program and moves some existing technologies to lower tiers, (2) fiscal year (FY) 2015 would see a budgetary increase of $32,110 for a part time economist at the Public Service Commission, (3) higher electricity prices would be incurred by the state and the Maryland University System in 2016 by $0.074/MWh, $4.78 million per year, a .06% increase on the current approximate average of $120/MWh (Maryland General Assembly (2014)).
[454] Biomass Energy Resource Center (October, 2013).

track REC eligibility. Larger scale district heating and CHP projects have a more integrated monitoring system already in place as a function of their internal plant operations and thermal energy sales (if applicable). This sector would be the primary beneficiary from the eligibility of biomass thermal units towards Vermont's voluntary renewable energy goals or other states' RPS programs.

In Vermont, a majority of wood biomass thermal projects are located at schools, hospitals, and other large institutions, and have a statewide nameplate capacity of 127 MmBtus.[455] If a TREC program similar to New Hampshire's is adopted in Vermont, those institutions would generate 37.2 TRECs per hour combined. The implementation of TRECs would also generate a wide range of monetary values for eligible generators, helping spur the employment of renewable thermal technologies.

[455] Vermont Sustainable Jobs Fund.

CONCLUSION

Vermont has come a long way to protect its forests since European settlement. Now Vermont's forests face different threats, including the increased use of woody biomass for energy, which, if poorly managed, could be as damaging as the devastation of the 19th century. But just as before, the threat comes from outside factors that have a great influence in how Vermont deals with their own forestlands. Thus, as well explained by Vermont Public Service Department,

> In this context, it is in the state's interest to impact the decisions of others, whose collective actions can materially impact the global climate and energy sector. Vermont can demonstrate a successful path forward and inspire broader action by recognizing the imperative to act on climate change and by developing policies that work for Vermont and advance the state's energy, economic, and environmental goals.[456]

With no regional agreement in place drawing the basic sustainability standards that should be followed by all Northeastern states, each state's attempt to adopt forestry excellence practices within its boundaries may not achieve the expected result. The adoption of specific standards by Vermont is a path that should be followed, in addition to a harmonization of definitions and guidelines among Northeastern states. This is a path needed, if Vermont and the Northeast want to develop this woody biomass energy, while protecting its forests and the environment.

[456] Vermont Public Service Department (December, 2013).

APPENDIX A

Table 3. Forest Guild recommendations for the Northeast presented in *Forest Biomass Retention and Harvesting Guidelines for the Northeast.*[457]

Rare forest and species protection	•Forest types S1, S2, S3 of the State National Heritage Program should not be harvested, unless necessary to perpetuate the type, and should follow guidance from local Natural Heritage Program and/or other local ecological experts. •Sensitive sites to control invasive species, enhance critical habitat, or reduce wildfire risk can be used to supply biomass in the short-term, but not in the long-term since restoration activity should be in place. •Old growth trees or late-successional forest should not be harvested for biomass.
Soil Fertility Maintenance	•In general, when 1/3 of the basal area is being removed on a 15 to 20 year cycle, 1/4 to 1/3 of the slash, tops, and limbs from harvest must be retained (i.e., downed woody material - DWM).[458] •Three main factors influence the percentage of tops and limbs that should be left onsite: number of live trees left on-site, time between harvests, and available soil nutrients. •As harvesting intensity increases, more slash, tops, and limbs from harvests should be left on-site. •As harvesting intensity decreases, less slash, tops, and limbs from harvests are required to protect site productivity. •Avoid harvesting on low-nutrient sites or adjust retention of tops, branches, needles, and leaves. • Retain DWM of all sizes on-site including FWM, CWM and large downed logs. • In general, leave DWM distributed across the harvest site. •Minimize the removal of needles and/or leaves by harvesting in winter, retaining FWM on-site, or leaving felled trees on-site to allow for needle drop.
Retention for Wildlife and Biodiversity	•Leave and protect litter, forest floor, roots, stumps, and large DWM. •Leave and protect live cavity trees, den trees, other live decaying trees, and snags (i.e., dead standing trees >10"). •Individual snags that must be felled for safety requirements should not be

[457] Forest Guild Biomass Working Group (May, 2010).

[458] The suggestion of leaving a third is often seen in biomass harvesting guidelines. However, as the North East State Foresters Association (NEFA) observes "[t]he metric of leaving 'a third' of the harvested top is common recommendation, but there is no evidence supporting whether this amount is effective for protecting soil fertility." (North East State Foresters Association (July, 2012)). In the same direction is conclusion reached in Biomass Energy Resource Center (June, 2007).

	removed from the forest. • If these forest structures do not currently exist, select and identify live trees to become these structures in the future (e.g. retaining live decaying trees and snags can eventually become large downed logs). • Leaving all snags or decaying trees may be impractical if forest disturbances occur. If an area is salvage logged, leaving un-salvaged patches totaling 5% to 15% of the area will provide biological legacies important to wildlife. However, the potential for insect populations to build up in dead trees may prohibit retention of unsalvaged patches in some situations. • Retain a variety of tree species as snags, DWM, and large downed logs. • In areas under even-aged management, leave an uncut patch within or adjacent to every 10 acres of regeneration harvest in a total 5% to 15% of the harvest area. • Build retention patches around large legacy trees, den or cavity trees, large snags, and large downed logs. • Marking retention trees and not removing them in subsequent harvests. • Maintain multiple vegetation layers, from the overstory canopy to the midstory, shrub, and ground layers for the benefit of wildlife and plant species diversity.
Water Quality and Riparian Zones	• DWM retention. • Leave and protect existing woody material in streams, ponds, and lakes. • Leave and protect live decaying trees (e.g., cavity/den trees), snags, and large downed logs in riparian or stream management zones. • Keep vernal pools free of slash, tops, branches, and sediment from forestry operations. • If slash falls into the pool during the breeding season, it is best to leave it in place to avoid disturbing egg masses or other breeding activity that may already be occurring. • Within 100 feet of the edge of a vernal pool, maintain a shaded forest floor. Also avoid ruts, bare soil, or sources of sediment near vernal pools. • Extra care should be taken working in or around forest wetlands. Wetlands are often low-fertility sites and may support rare natural communities, so removal of DWM may be inappropriate.
Harvesting and Operations	• Protect forest land from conversion to non-forest use and native forest from conversion to plantations. • Involve a professional forester (or a licensed forester) in development of a long-term management plan and supervision of harvests. • Engage a certified logger from the Master Logger Certification Program. • Follow all best management practices (BMPs). • Plan and construct roads and skid trails based on professional advice and BMPs.

	• Integrate biomass harvesting with other forest operations. E.g. re-entering a site where timber was recently harvested to remove biomass can increase site impacts and may harm post-harvest regeneration. • Use low impact logging techniques (directional felling or use of slash to protect soil from rutting and compaction). • Use appropriate equipment matched to site and operations.
Carbon Storage	• When managing for shade-tolerant and mid-tolerant species, a shift from even-aged to uneven-aged management will increase the retention of carbon on-site. • When appropriate to the tree species, a shift to regeneration methods that encourage advanced regeneration, such as from clearcut to shelterwood, will retain carbon on-site for longer periods. • Retain reserve trees or standards or delay their removal. • Delay regeneration harvests or lengthen harvest cycles to grow trees for longer times and to larger sizes. • Encourage rapid regeneration. • Capture natural mortality as efficiently as possible while retaining adequate numbers of snags, decaying trees, and DWM. • Use biomass harvests to concentrate growth on healthy crop trees that can be used to manufacture products that hold carbon for long periods or replace carbon-intensive products.

APPENDIX B

SUSTAINABLE INITIATIVES IN THE EUROPEAN UNION, EUROPEAN COUNTRIES AND CANADIAN PROVINCES

EUROPEAN UNION (EU)

Biomass is an important renewable fuel source in the EU.[459] Biomass is mainly derived from wood, with the demand for woody biomass growing too fast for the current supply to support.[460] Aware of the issues related to woody biomass harvesting, the EU has taken some steps to regulate this source. Under the EU Directives, the European Commission (EC) sets out minimum standards and goals to be followed by country members. However, country members may set more stringent targets and standards at the national level.

The first EU Directive regarding biomass deployment was the Directive 1998/70/EC on petrol and diesel fuels. [461] Enacted in 1998, and further amended in 2009 by Directive 2009/30/EC, the directive established the Fuel Quality Standards to be followed by transportation fuels in order to reduce pollution. Sustainability criteria shall also be met in order to fulfill the GHG intensity reduction obligation. [462] Among those binding criteria are that GHG emission savings from biofuels shall be at least 35 percent, biofuels' raw material shall not come from lands with high biodiversity value, or from high carbon stock (e.g. wetlands). [463] The Directive, however, *does not include solid and gaseous biomass*.[464] Additionally, the Directive required the EC to report on the requirements to establish a sustainability scheme for biomass and biofuels.[465]

In March 2007, "the European Council called for Criteria and provisions to ensure sustainable production and use of bioenergy to avoid conflicts between different uses of biomass."[466] In 2008, the EC released a proposal to develop standards for renewable energy, specifically biofuels

[459] The "EU is a unique economic and political partnership between 28 European countries that together cover much of the continent." (European Union).
[460] European Biomass Industry Association.
[461] Biomass Technology Group (2008).
[462] European Commission (July, 2014).
[463] Directive 2009/28/EC, Article 17 (2) and (3), respectively.
[464] European Commission (2013).
[465] European Renewable Energy Council (*Sustainable Bioenergy: Biofuels and Bioliquids).*
[466] Biomass Technology Group *supra* at note 461.

and biomass sustainability criteria and certification schemes.[467] Later that year, a "Sustainability Criteria & Certification Systems for Biomass Production" report was published.[468] This report analyzed the existing certification schemes for biomass including, "forest certification schemes, biomass energy crops certification systems, certification systems used in the power sector, and certification systems related to emission trading."[469] The report recommended the EU to develop minimum criteria for biomass regulations and voluntary sustainability requirements.[470]

The Directive required the EC to report on the requirements to establish a sustainability scheme for biomass and biofuels. The report was published in in February of 2010, when 90 percent of the biomass utilized in the EU was reported to come from forests' sources and by-products.[471] This report did not propose binding sustainability schemes for biomass due to the added economic costs of developing these sustainability standards.[472] Instead, the report simply recommended that the EU member states "with national sustainability standards planned or in place to follow, in almost all respects, the same criteria as those laid down for biofuels and bioliquids."[473] Further, the report "encourages industry, governments and NGOs to set up 'voluntary schemes' to certify biofuel sustainability."[474] Other recommendations in the report included:

- a general prohibition on the use of biomass from land converted from forest, other high carbon stock areas and highly biodiverse areas;
- a common greenhouse gas calculation methodology which could be used to ensure that minimum greenhouse gas savings from biomass are at least 35 percent (rising to 50 percent in 2017 and 60 percent in 2018 for new installations) compared to the EU's fossil energy mix;[475]
- the differentiation of national support schemes in favor of installations that achieve high energy conversion efficiencies; and
- monitoring of the origin of biomass.[476]

[467] *Id.*
[468] *Id.*
[469] *Id.*
[470] *Id.*
[471] European Commission *supra* at note 462.
[472] *Id.*
[473] European Commission; Directorate General for Energy (July, 2011).
[474] European Renewable Energy Council (*Sustainable Bioenergy: Biofuels and Bioliquids).*
[475] Annex I of COM(2010)11 provides a methodology for calculating greenhouse gas performance of solid and gaseous biomass used in electricity, heating and cooling. Available at European Commission (February, 2010).
[476] European Commission; Directorate General for Energy *supra* at note 473.

The EU Committee for Standardization is currently undergoing development of standards for solid biofuels regulation, through the CEN/TC 355.[477] Additionally, a project entitled Bionorm has been funded through the EU to provide a scientific basis for these standards.[478] In the EU solid biofuels include woody biomass, herbaceous biomass, fruit biomass, and a category of biofuels defined as "blends and mixtures" – aquatic and animal biomass are excluded from the current standardization process.[479]

In addition, since 2001 the EU adopted a Renewable Portfolio Standards (RPS) on an EU-wide scale.[480] The RPS promotes the use of renewable energy and includes biomass as well as other renewable sources. Under this Directive, biomass is defined as "the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste."[481] The directive also requires that biomass conversion technologies have an efficiency of at least 85 percent for residential and commercial applications, and 70 percent for industrial applications.[482]

UNITED KINGDOM (UK)

The UK focus is mainly on the transportation sector, although there has been some development in the area of renewables in the heating sector. In 2005, the Renewable Transport Fuel Obligations was released to include renewable fuels into the country's transport fuels.[483] This requires transport fuel suppliers to obtain some of their fuel source from a renewable source, including biomass.[484] The verification of the renewable sources is done through certificates, and a yearly reporting is required to ensure compliance.[485]

Recently, the U.K. Department of Energy and Climate Change (DECC) has released new regulations regarding renewable heat as part of the Renewable Heat Initiative (RHI).[486] The plan

[477] Biomass Energy Centre (*Standards).*
[478] Pieter Kofman (2012).
[479] *Id.*
[480] Trent Berry and Matt Jaccard (2001).
[481] Biomass Energy Center (May, 2006).
[482] Directive 2009/30/EC Article 13 (6).
[483] Jinke Van Dam *et al* (2008).
[484] Directive 2009/28/EC Article 13 (6).
[485] Biomass Technology Group *supra* at note 461.
[486] Erin Voegele (March, 2013).

includes sustainability requirements for biomass on GHG emissions and land use criteria.[487] The plan requires emission limitations for air quality criteria of maximum of 30 grams particulate matter per gigajoule net rated thermal input from biomass installations, and that biomass facility owners provide a certificate to the government certifying compliance with this standard and others.[488]

Regarding the land use criteria, the plan establishes that solid woody biomass that follows the UK Public Procurement Policy for Timber and for biomass sourced from a Forest Law Enforcement, Governance and Trade (FLEGT) partner to be considered as meeting the land criteria. [489] In addition, perennial energy crops planted to meet the sustainability requirements set under the Energy Crops Scheme for England, or its equivalent, will be considered as meeting the land criteria. [490] To demonstrate compliance with these requirements, users of biomass must either report to the government or source their wood from an approved suppliers list, developed by the government of suppliers that are in compliance with these sustainability requirements.[491]

NETHERLANDS

The Netherlands was one of the first European countries to implement a Biomass Action Plan (BAP). [492] In 2007, the Dutch Commission developed a report due to concerns from increasing imports of wood pellets, agricultural wastes, and bio-oil for use in electricity.[493] The report, entitled Sustainable Production of Biomass, proposed sustainability criteria based on six criteria including greenhouse gas emissions, competition with food and other local applications, biodiversity, environment, prosperity, and social well-being.[494] From the six initial criteria the report developed nine basic principles of sustainability criteria for biomass, including minimal requirements, as well as reporting obligations.[495] Based on the report, the Dutch Commission

[487] *Id.*
[488] United Kingdom Department of Energy & Climate Change (2013).
[489] *Id.*
[490] *Id.*
[491] *Id.*
[492] Biomass Action Plan (BAP) Driver (January, 2009).
[493] Jinke Van Dam *et al supra* at note 483.
[494] Biomass Technology Group *supra* at note 461.
[495] Jinke Van Dam *et al supra* at note 483.

developed a Testing Framework for Sustainable Biomass.[496] These are described in the following table:

Principle	Criteria
1. The greenhouse gas balance of the production chain and application of the biomass must be positive.	1.1. In the application of biomass a net emission reduction of greenhouse gases must take place along the whole chain. The reduction is calculated in relation to a reference situation with fossil fuels.
2. Biomass production must not be at the expense of important carbon sinks in the vegetation and in the soil.	2.1. Conservation of above-ground (vegetation) carbon sinks when biomass units are installed. 2.2. The conservation of underground (soil) carbon sinks when biomass units are installed.
3. The production of biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, building materials).	3.1. Insight into the change of land use in the region of the biomass production unit. 3.2. Insight into the change of prices of food and land in the area of the biomass production unit.
4. Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity	4.1. No violation of national laws and regulations that are applicable to biomass production and the production area. 4.2. In new or recent developments, no deterioration of biodiversity by biomass production in protected areas. 4.3. In new or recent developments, no deterioration of biodiversity in other areas with high biodiversity value, vulnerability or high agrarian, nature and/or cultural values. 4.4. In new or recent developments, maintenance or recovery of biodiversity within biomass production

[496] Biomass Technology Group *supra* at note 461.

	units. 4.5. Strengthening of biodiversity where this is possible, during development and by the management of existing production units.
5. In the production and processing of biomass, the soil, and soil quality must be retained or even improved.	5.1. No violation of national laws and regulations that are applicable to soil management. 5.2. In the production and processing of biomass best practices must be applied to retain or improve the soil and soil quality. 5.3. The use of residual products must not be at variance with other local functions for the conservation of the soil.
6. In the production and processing of biomass ground and surface water must not be depleted and the water quality must be maintained or improved.	6.1. No violation of national laws and regulations that are applicable to water management. 6.2. In the production and processing of biomass best practices must be applied to restrict the use of water and to retain or improve ground and surface water quality. 6.3. In the production and processing of biomass no use must be made of water from non-renewable sources.
7. In the production and processing of biomass the air quality must be maintained or improved.	7.1. No violation of national laws and regulations that are applicable to emissions and air quality. 7.2. In the production and processing of biomass best practices must be applied to reduce emissions and air pollution. 7.3. No burning as part of the installation or management of biomass production units (BPUs).

8. The production of biomass must contribute towards local prosperity.	8.1. Positive contribution of private company activities towards the local economy and activities.
9. The production of biomass must contribute towards the social well-being of the employees and the local population.	9.1. No negative effects on the working conditions of employees. 9.2. No negative effects on human rights. 9.3. The use of land must not lead to the violation of official property and use, and customary law without the free and prior consent of the sufficiently informed local population. 9.4. Positive contribution to the well-being of local population. 9.5. Insight into possible violations of the integrity of the company.[497]

BELGIUM

Belgium implements biomass policy through regional agreements.[498] These include the Action Plan for Renewable Electricity, and the Action Plan for Renewable Heating and Cooling.[499] Besides, Belgium has certification systems in place at the local level in three regions: Brussels, Flanders, and Wallonia.[500] These certification systems are for renewable energy sources (such as biomass) and address combined heating and power requirements.[501]

> The system in Flanders in based upon the energy balance and the use of fossil energy along the supply chain that is then subtracted 'pro rata' from the granted certificate per MWhe of green electricity. The system in Wallonia is compatible with the one in the Brussels region and is based upon avoided fossil CO_2 emissions according to a LCA [life-cycle analysis] with respect to the reference of the combined cycle power plant firing natural gas with an efficiency of (for now) 55%. Walloon authority imposes that each supplier undergoes an audit within 6 months for certification of imported biomass, which examines the sustainability of the

[497] Jinke Van Dam *et al supra* at note 483.
[498] Biomass Action Plan (BAP) Driver *supra* at note 492.
[499] *Id.*
[500] Jinke Van Dam *et al supra* at note 483.
[501] *Id.*

> wood sourcing as well as detail of the energy balance (through an energy audit including GHG emissions) of the whole supply chain. The sustainability of the wood sourcing can be delivered according to (1) forest certificates as FSC, (2) a traceable chain management system at the suppliers end or, in absence of such certification, (3) all public documents originating from independent bodies making a review of forest management or control in the considered country. SGS international, accepted as independent body by all Belgian authorities for granting green certificates, analyzes for each producer the global supply chain. If the product would appear in contradiction with the sustainability principle, the CwaPE (energy regulator in Wallonia) has the right to cancel the granted green certificates. So far, Flanders authorities have not requested audits or a certification procedure for imported biomass by law.[502]

These certification systems are called "Green Certificate Systems," providing incentives to develop renewable energy in a more sustainable way.[503] The case studies discussed above exemplify examples of European countries with extensive regulations of sustainable biomass harvesting, beyond the EU Directives.

CANADA

Despite Canada's long woody biomass history, Canada works in a similar way as the United States. Without clear sustainability standards for biomass harvesting at the national level, each province was left to design its own sustainable standards. Many of the provinces have established voluntary standards for sustainable biomass harvesting, or incorporated biomass harvesting guidelines into their forest management acts.[504] Although all of the Canadian provinces address biomass in some form (whether it be a guideline or a requirement), regulation of biomass is by no means uniform across the provinces.[505]

British Columbia, for instance, is Canada's most biologically diverse province and therefore has some of the most stringent forest management guidelines in the world.[506] The province has a Forest Range and Practices Act, under which biomass harvesting is regulated currently.[507] Under the Act, prior to conducting harvesting activities, the interested person needs to obtain the

[502] *Id.*
[503] European Renewable Energy Council (2009).
[504] Wood Pellet Association of Canada (November, 2013).
[505] World Wildlife Fund (February, 2010).
[506] Wood Pellet Association of Canada (November, 2013).
[507] World Wildlife Fund *supra* at note 505.

minister's approval of a forest stewardship plan for the area.[508] The province also restricts the amount of wood permitted to be harvested within its boundaries in the period of one year through an Annual Allowable Cut for forest harvesting, setting guidelines for the maximum amount of forest that can be harvested, regardless of country demand.[509] In addition, all harvested forest areas must be regenerated through replanting or natural regeneration, and 80 percent of all harvested areas in British Columbia must be replanted within 1.8 years after harvest.[510]

Another example is Nova Scotia Province. This Canadian Province has two main acts governing biomass harvesting: the Water Course and Wildlife Habitat Regulations, and the Interim Code of Forest Practice.[511] Both outline targets for sustainable harvesting of biomass and provide requirements for the number of trees not to be harvested as well as guidelines to ensure that biomass harvesting mirrors natural forest growth as much as possible.[512] The Code of Forest Practice also provides that silvicultural operations shall comply with ground disturbance guidelines according with the Forest Ecosystem Classification for each soil type, and that harvesting activities shall be scheduled in times that minimize environmental damage and site degradation.[513]

In furtherance of these guidelines, Nova Scotia has recently established a Provincial Biomass Harvesting Working Group tasked with developing regulations for sustainable biomass harvesting in the province.[514] As of 2013, Nova Scotia has proposed revisions to the forest act regulations. These proposed regulations require biomass users to register in the Registry of Buyers starting in 2013, and further provide yearly reports of the wood used which must meet the Forest Sustainability Regulations.[515] These new regulations additionally require tracking of sustainable use of forest resources as well as new sustainability requirements for biomass

[508] SBC 2002 Chapter 69.
[509] Wood Pellet Association of Canada *supra* at note 5068.
[510] *Id*.
[511] World Wildlife Fund *supra* at note 505.
[512] *Id*.
[513] Nova Scotia Department of Natural Resources (August, 2012).
[514] World Wildlife Fund *supra* at note 505.
[515] Province of Nova Scotia, *Forest Sustainability Regulations Made under Section 40 of the Forests Act R.S.N.S. 1989, c. 179 and Section 15 of the Finance Act S.N.S. 2010, c. 2 O.I.C. 2001-570 (December 7, 2001), N.S. Reg. 148/2001 as amended up to O.IC. 2007-299 (May 26, 2007), N.S. Reg. 284/2007.*

registered buyers.[516] Buyers of biomass must utilize and submit forms to ensure they are meeting sustainability requirements, which include criteria for regeneration of biomass.[517]

New Brunswick implemented in October of 2008 the Forest Biomass Harvesting Policy to ensure sustainable management while harvesting for biomass in the Crown's lands.[518] The policy identifies areas that are ineligible for biomass harvesting because they are areas of "high risk" in terms of sustainability.[519] The policy also establishes that biomass harvesting is to be done only in low risk areas, must minimize soil disturbance, and "is limited to the harvest of residual tree tops, branches, foliage, non-merchantable woody stems of trees and shrubs, pre-existing dead woody material and flail chipping residue."[520] Pulpwood fiber generated from full-tree chipping is not considered biomass under this policy.[521]

A majority of the remaining provinces do not have a specific policy regarding biomass harvesting but are in the process of developing one. For example, Quebec has a Sustainable Development Act, which governs sustainable development and calls for the development of a Biomass Action Plan.[522] As part of this plan, for biomass harvesting, the plan requires 30 percent of the available woody biomass should be left untouched to ensure further sustainability of the woody biomass supply.[523] Additionally, the Crown Forest Sustainability Act governs Ontario's forest management.[524] Ontario is currently undergoing revisions to its forest management policies and "to address the growing interest in biomass harvesting for bio-energy production, the new stand-level guide will include a specific section on biomass harvesting which will summarize all of the current requirements related to post harvest onsite retention standing and downed woody debris."[525]

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[516] According to the Province of Nova Scotia *Forest Sustainability Regulations,* registered buyers "means a person who: (i) owns or operates a wood processing facility in the Province, (ii) exports, or possesses for export, primary forest products, (iii) imports primary forest products, (iv) sells or acquires for sale more than 1000 m^3 solid of primary forest products as a fuel, or (v) acquires primary forest products for producing energy."

[517] Province of Nova Scotia, *Forest Sustainability Regulations Made under Section 40 of the Forests Act R.S.N.S. 1989, c. 179 and Section 15 of the Finance Act S.N.S. 2010, c. 2 O.I.C. 2001-570 (December 7, 2001), N.S. Reg. 148/2001 as amended up to O.IC. 2007-299 (May 26, 2007), N.S. Reg. 284/2007.*

[518] New Brunswick Forest Biomass Harvesting (FMB 019 2008).

[519] *Id.*

[520] *Id.*

[521] *Id.*

[522] World Wildlife Fund *supra* at note 505.

[523] *Id.*

[524] *Id.*

[525] *Id.*

APPENDIX C

MODEL MOU FOR ELIGIBLE WOODY BIOMASS SOURCES UNDER STATES' RENEWABLE PORTFOLIO STANDARDS AND GOALS

Memorandum of Understanding[526]

WHEREAS, the states of ____ ("Signatory States") each individually have adopted a Renewable Portfolio Standard or Renewable Energy Goals to ensure the increased use of energy from renewable energy sources, which constitute important part of the effort to reduce greenhouse gas emissions, and to ensure that the each of the Signatory State has legal tools to comply with the established state's emission cap under the Regional Greenhouse Gas Initiative; and

WHEREAS, the Signatory States include woody biomass sources as eligible renewable energy sources under its Renewable Portfolio Standards or Renewable Energy Goals; and

WHEREAS, the definition and requirements regarding eligible woody biomass sources vary greatly among the Signatory States' Renewable Portfolio Standards or Renewable Energy Goals; and

WHEREAS, the adoption of different standards for woody biomass under the Signatory States' Renewable Portfolio Standards or Renewable Energy Goals frustrates local attempts to conserve, improve, and protect each state's forest environment while providing a sustainable, environmentally friendly renewable energy source; and

WHEREAS, the adoption of uniform definition and standards for eligible woody biomass sources for Renewable Portfolio Standards and Renewable Energy Goals will ensure that only electric units that uses wood sustainably managed will be allowed to comply with these programs, and generate Renewable Energy Credits under Renewable Portfolio Standards or equivalent; and

WHEREAS, woody biomass sources flow freely among the Signatory States, with wood-fired biomass facilities often requiring imported wood supply for its energy generation; and

WHEREAS, forests are part of a greater ecosystem, which most of the time surpass states boundaries and presents regional forestry concerns; and

WHEREAS, the Signatory States wish to establish themselves as world leaders in the creation, development, and deployment of efficient, sustainable woody biomass source; and

WHEREAS, the time to address forestry concerns regarding woody biomass harvesting is now, and the Signatory States cannot afford delay to take action to ensure sustainability

[526] This draft model Memorandum is based on language from the RGGI MoU, language from Renewable Portfolio Standards and equivalent programs, in particular Vermont and Massachusetts, language from EU Directive 2009/30/EC, and language from North Springfield Sustainable Energy Project and Vermont Agency of Natural Resources Memorandum of Understanding signed on June 11, 2013.

minimum standards to protect states' forests. Thus, the Signatory States must work together at the regional level to promote similar sustainable forest management practices across the Signatory State borders.

NOW THEREFORE, the Signatory States express their mutual understandings and commitments as follows:

1. OVERALL ENVIRONMENTAL GOAL

The Signatory States establish common sustainability criteria for woody biomass sources to be considered eligible renewable energy sources under Signatory States' Renewable Portfolio Standards and Renewable Energy Goals. The criteria aim at only allowing woody biomass sources that are harvested on a sustainable basis, and which adopt forest management practices that ensure forests' health and productivity, protects water quality, soil quality, biodiversity, and the environment, and reduces greenhouse gas and carbon emissions are able to be used for the programs compliance, and to generate Renewable Energy Credits or equivalent.

2. ELIGIBLE WOODY BIOMASS

i. Common Definition of Woody Biomass

"Woody biomass" means a resource from organic plant material, such as wood derived from biomass energy plantations, from the thinning or trimming of trees and/or from a forest floor, provided that the wood is not old-growth timber, or from ground or shredded pallets, bark, wood chips or pellets, shavings, sawdust and slash, or other clean, unaltered scrap wood, that is being consumed at a harvest rate at or below its natural regeneration rate.

When whole tree harvesting is involved, the Signatory State shall adopt retention standards regarding forest soil health and wildlife trees, such as decaying live trees, city trees, snags and mast-producing trees.

Woody Biomass from land with high biodiversity value and land with high carbon stock are strongly discouraged.

ii. Eligible Criteria for Woody Biomass Generation Units

Woody Biomass Generation Units may only qualify for Renewable Portfolio Standards or Renewable Energy Goals if the following sustainability criteria are met:

(1) The design system efficiency achieves an overall efficiency of, at least, 50 percent over the course of one year;

(2) An average emission rate of equal or less than .075 pounds of nitrogen oxides per million BTU of heat input, an average emission rate of equal or less than .02 pounds of particular matter per million Btu of heat input and other low-emission eligibility criteria as stated by the host Signatory State;

(3) Provide a Lifecycle Greenhouse Gas Emission Analysis that demonstrates that over the course of 20 years the Biomass Generation Unit yield at least 50 percent reduction of greenhouse gas emissions per unit of useful energy when compared to the emissions from the operation of the most efficient commercially available technology from the fuel displaced by the Biomass Generation Unit;

(4) Comply with federal and state air quality standards, and obtain the required air permits;

(5) Adopt a biomass harvesting plan developed by a licensed forester, and approved by the responsible host state forest agency;

(6) Adopt Procurement Standards as developed and approved by the host Signatory State; and

(7) Present an Annual Compliance Report.

"Annual Compliance Report" shall provide the records of the wood procured in the past year, including information about the woody biomass location of origin, type and amount procured. The Annual Compliance Report shall also provide evidence that the Biomass Generation Unit followed the biomass harvesting plan, adopted the procurement standards approved by the host Signatory State, and complied with other sustainability criteria set forth in this Section.

"Biomass Generation Unit" means the facility that converts an eligible woody biomass resource into electrical energy.

"Biomass Harvesting Plan" shall develop standards that seek forest health and sustainability, and deal specifically with forestry concerns regarding air and water quality, soil health and productivity, biological diversity and wildlife habitat, carbon sequestration and storage.

"Design system efficiency" represents the sum of the full load design thermal output and electric output divided by the heat input.

"Lifecycle Greenhouse Gas Emission Analysis" refers to the aggregate quantity of greenhouse gas emissions including direct emissions and significant indirect emissions, such as significant emissions from land use changes, temporal changes in forest carbon sequestration and emissions resulting from biomass harvests, regrowth, and avoided decomposition related to the full woody biomass lifecycle, including all stages of fuel and feedstock production, generation, and distribution to the ultimate consumer.

3. MONITORING AND EVALUATION

Each Signatory State shall develop a monitoring program, which will monitor and evaluate harvesting practices of wood supplied to Biomass Generation Units. Every two years, the Signatory States shall report to the Regional Organization on the state measures taken to respect

the sustainability criteria set out in Section 2. The reports shall be accompanied, where appropriate, by proposals for advanced sustainability scheme for forest biomass based on the best available scientific evidence.

Every five years, the Signatory States shall develop a Forest Impact Assessment regarding the impacts on the state and regional forests resulting from woody biomass removal. The Forest Impact Assessment shall evaluate the appropriateness and accuracy of the Section 2 criteria and the greenhouse gas accounting according to the Lifecycle Greenhouse Gas Emission Analysis, through the analysis of the amount of woody biomass harvested and techniques deployed, additionally to external factors that constantly changes the forests, including: (i) weather related stressors, (ii) native insects and diseases, (iii) introduction of non-native species and insects, (iv) acid deposition, (v) forest growth rate and maturing, among others.

4. REGIONAL ORGANIZATION

In order to facilitate the ongoing administration compliance with these criteria and evaluate the appropriateness of those, the Signatory States agree to assign and maintain an existing Regional Organization (RO). The RO will be a non-profit, and shall have an Executive Board comprised of two representatives from each Signatory State, and shall act as the forum for collective deliberation and action among the Signatory States. The RO shall also track each Signatory State's progress, receive and store data on how each state is maintaining forest health and productivity, while reducing greenhouse gas emissions. The RO may also conduct document inspection, audits, or sites visits as necessary to verify Biomass Generation Units compliance with the criteria set forth in Section 2.

The RO will also be responsible for reviewing Signatory State's Forest Impact Assessments. If the RO finds that the proposed approach is resulting in significant impacts on long-term forest sustainability and greenhouse gas emission, the Signatory States shall review the present agreement and develop criteria that ensure that forest health, productivity and reduction of greenhouse gas emissions goals are met.

The RO shall also provide technical assistance to Signatory States which require aid in developing and approving biomass harvesting, and procurement standards, as well as in the creation, development, and deployment of woody biomass energy facilities. The RO shall have no regulatory or enforcement authority with respect to these criteria.

5. ADDITION OR REMOVAL OF SIGNATORY STATES

A non-signatory state may become a Signatory State by agreement of the Signatory States and upon signing of this Memorandum.

A Signatory State may, upon 30 days written notice, withdraw its agreement to this Memorandum and become a non-signatory state.

6. COMPLEMENTARY FORESTRY, ENVIRONMENTAL, & ENERGY POLICIES

Each Signatory State will maintain and, where feasible, expand forestry, environmental, and energy policies to include and promote the sustainable use of woody biomass as a renewable source of energy. Such policies may include, but are not limited to, heavy cutting laws, tax incentive programs, and environmental quality incentive programs. Additionally, each Signatory State shall comply with all federal energy statutes, regulations, and policies, such as the U.S. Farm Bill, the National Forest Management Act, and the Forest Service's Cooperative Forestry Assistance Act for forest stewardship.

7. AMENDMENT

This Memorandum may be amended in writing upon the collective agreement of the authorized representatives of the Signatory States.

[SIGNATURES ON NEXT PAGES]

APPENDIX D

MODEL MOU FOR BIOMASS HARVESTING GUIDELINES & PROCUREMENT STANDARDS OF WOODY BIOMASS

Memorandum of Understanding[527]

WHEREAS, the states of ____ ("Signatory States") each individually have a policy to harvest and procure woody biomass for energy in a sustainable, environmentally friendly way that promotes good forest management in a way that seeks to conserve, improve, and protect each state's forest environment and provides an alternative, renewable energy source; and

WHEREAS, there is a growing scientific consensus that the increase in anthropogenic emissions of greenhouse gases, particularly carbon dioxide, is enhancing the natural greenhouse effect resulting in changes in the Earth's climate; and

WHEREAS, climate change poses serious potential risks to human health, ecosystems, and the environment; and

WHEREAS, developing a more renewable energy supply that allows for the creation, development, and deployment of more efficient fuel burning technologies and processes will increase energy efficiency and will lead to less reliance on fossil fuels; and

WHEREAS, reducing dependence on foreign fossil fuels will enhance the region's economy and promote dependence on local forest resources as an option for renewable energy; and

WHEREAS, the Signatory States wish to establish themselves and their biomass industries as world leaders in the creation, development, and deployment of this efficient, renewable energy source; and

WHEREAS, creating and relying on forest resources for wood biomass can be a renewable and efficient form of energy if created, developed, and deployed in a manner that encourages sustainable forest management; and

WHEREAS, climate change is occurring now, and the Signatory States cannot afford delay to take action to reduce greenhouse gas and carbon emissions that cause climate change. Thus, the Signatory States must work together at the regional level to control such emissions, share forest natural resources, and promote similar forest management goals across the Signatory State borders.

[527] This draft model Memorandum is based on language form the RGGI MoU, as well as language from several Vermont laws, regulations, and polices, Vermont's Biomass Energy Development Working Group Final Report, language from North Springfield Sustainable Energy Project and Vermont Agency of Natural Resources MoU signed on June 11, 2013, and other third-party guidelines and standards, such as SFI and AFTS.

NOW THEREFORE, the Signatory States express their mutual understandings and commitments as follows:

1. OVERALL ENVIRONMENTAL GOAL

The Signatory States commit to propose for legislative and/or regulatory approval harvesting guidelines and procurement standards aimed at creating a sustainable forest management scheme for harvesting and procuring woody biomass for energy in a way that protects water quality, soil quality, biodiversity, the environment, and reduces greenhouse gas and carbon emissions based on the definitions, guidelines, and standards below.

2. BIOMASS, HARVESTING GUIDELINES, & PROCUREMENT STANDARDS

i. Common Definition of Woody Biomass

A versatile renewable fuel source derived from organic plant material, such as wood derived from biomass energy plantations, from the thinning or trimming of trees and/or from a forest floor, provided that the wood is not old-growth timber, or from ground or shredded pallets, bark, wood chips or pellets, shavings, sawdust and slash, or other clean, unaltered scrap wood, that can be used to generate electricity, provide heat, and develop alternative transportation fuels having an average emission rate of equal to or less than .075 pounds of nitrogen oxides per million BTU of heat input, and whose total power production does not exceed 100 megawatts.

ii. Biomass Harvesting Guidelines

- Each Signatory State must develop biomass harvesting guidelines that shall be used by public, state, and private landowners to help ensure long-term forest health and sustainability.
- Biomass harvesting guidelines should be adopted for wood suppliers selling directly to consumers, as well as a compliance scheme so that consumers know that suppliers are conforming to the guidelines through a certification program. Such a certification program would track and certify chain of custody and provide a labeling service so purchasers can make responsible purchasing choices.
- Biomass harvesting guidelines shall include standards allowing consumers to know that forests are being harvested following forest excellency practices and in compliance with applicable laws, and standards creating contracts with suppliers, so suppliers know their responsibilities to consumers.
- Biomass harvesting guidelines shall follow all recognized silvicultural practices in each state.
- Each Signatory State shall develop harvest plans for retention where whole tree harvesting occurs. The retention standards shall consider the amount of area harvested, and establish a minimum number of trees to be retained per acre and the minimum diameter breast height of the trees to be retained.
- Each Signatory State shall implement Acceptable Management Practices for Maintaining Water Quality during harvesting to protect all waters, waterways, and wetlands.

- Harvesting cannot be detrimental to soil quality, including following accepted soil erosion control practices.
- Harvesting guidelines must protect biodiversity, wildlife habitats, and endangered species.
- Each Signatory State shall seek to maintain and protect forest aesthetics and recreation when creating and implementing biomass harvesting guidelines, as well as accommodate different beneficial services provided by healthy forests.
- When developing biomass harvesting guidelines, Signatory States shall consult with professional foresters, conservationists, and scientists to make sure each guideline maintains forest health and promote sustainability.
- When developing harvesting guidelines, Signatory States may look to and utilize core principles, objectives, performance measures, and indicators used and published by the Sustainable Forestry Initiative, Forest Stewardship Council, and American Farm Tree System.

iii. Procurement Standards

- Each Signatory State must develop procurement standards to be used by all wood-fired biomass electric facilities, state agencies and departments in procuring wood products, and shall include specifications on the retention of live and dead trees.
- Each Signatory State shall incorporate these procurement standards into already existing permitting standards, if applicable, or shall amend existing standards to meet the requirements set forth in this Memorandum.
- Each Signatory State shall develop a monitoring program, which will monitor and evaluate harvesting practices. Monitoring standards could be the same or different for supplier, distributors, and consumers.
- Procurement standards shall include compliance standards. Signatory States may choose the type of compliance standard, which will serve as verification of compliance with biomass harvesting guidelines and to help consumers verify that harvesting guidelines are being used. Each Signatory State may choose from one of the following compliance standards:
    - Second-Party Verification: a buyer verifies that a supplier or the products of a supplier conform to a certain standard; or
    - Third-Party Verification: an independent third party verifies that a supplier or its products conform to a certain standard and is considered to provide the most assurance that a standard is met (this can be governmental or nongovernmental).
- Generally, procurements standards should include a variation of the following:
    - An approved forest management plan and map;
    - The requirement to use of well-maintained equipment;
    - The requirement to use non-petroleum lubricants;
    - The requirement to maintaining proper buffers for special habitats;

- The requirement of careful monitoring of all operations for compliance;
- Full compliance with all state and federal water quality practices;
- The requirement that all trails, roads, and logging landings to be marked prior to the harvesting;
- The requirement for the use of equipment that exerts the lowest possible ground pressure;
- The requirement that the timber-harvesting access network be carefully designed and constructed, and that it should not expose mineral soil;
- The requirement that trails, roads, and landings be located on easily compacted soils;
- The requirement to minimize the number and extent of truck roads;
- The requirement that clear cutting of large patches larger than two acres should be avoided;
- The requirement that cavity and/or snag trees, as well as large, down trees be retained;
- The requirement that largest trees should be grown, and longest rotations should be used;
- The requirement that, when considering species, native species should have a higher priority than non-native species;
- The requirement of using natural regeneration as much as possible; and
- The requirements that tree-felling should be limited to slopes of 60% or less, mechanical harvesting should be limited to slopes of 30% or less, all materials that are less than 4 inches in diameter should remain at the site, all trees to be removed should be marked prior to harvest, and cutting cycles should be between 10 and 15 years.

- When developing procurement standards, Signatory States shall consult with professional foresters, conservationists, and scientists to make sure each standard maintains forest health and promotes sustainability.

3. MODEL RULE FOR THE ESTABLISHMENT OF WOODY BIOMASS HARVESTING GUIDELINES AND PROCUREMENT STANDARDS

The Signatory States are collectively developing a draft Model Rule to serve as the framework for the creation of necessary and/or regulatory authority to establish these biomass harvesting guidelines and procurement standards, in accordance with this Memorandum of Understanding. Each Signatory State commits to establish these harvesting guidelines and procurement standards in a statute and/or regulation and have that state's component to the regional Program effective as soon as practicable.

4. REGIONAL ORGANIZATION

In order to facilitate the ongoing administration of these harvesting guidelines and procurement standards, the Signatory States agree to assign and maintain an existing Regional Organization (RO). The RO will be a non-profit, shall have an Executive Board comprised of two representatives from each Signatory State, and shall act as the forum for collective deliberation and action among the Signatory States. The RO shall also track each Signatory State's progress and receive and store data on how each state is maintaining forest health, while reducing greenhouse gas emissions. The RO shall also provide technical assistance to states which require aid in creating, developing, and deploying these harvesting biomass guidelines and procurement standards. The RO shall have no regulatory or enforcement authority with respect to these harvesting guidelines and procurement standards.

5. ADDITION OR REMOVAL OF SIGNATORY STATES

A non-signatory state may become a Signatory State by agreement of the Signatory States and upon signing of this Memorandum.

A Signatory State may, upon 30 days written notice, withdraw its agreement to this Memorandum and become a non-signatory state.

6. PROGRAM MONITORING AND REVIEW

The Signatory States agree to monitor the progress of the implementation of the biomass harvesting guidelines and procurement standards, as well as the creation, development, and deployment of woody biomass energy facilities, on an on-going basis.

7. COMPLEMENTARY FORESTRY, ENVIRONMENTAL, & ENERGY POLICIES

Each Signatory State will maintain and, where feasible, expand forestry, environmental, and energy policies to include and promote the sustainable use of woody biomass as a renewable source of energy. Such policies may include heavy cutting laws, tax incentive programs, and environmental quality incentive programs. Additionally, each Signatory State shall comply with all federal energy statutes, regulations, and policies, such as the U.S. Farm Bill, the National Forest Management Act, and the Forest Service's Cooperative Forestry Assistance Act for forest stewardship.

8. AMENDMENT

This Memorandum may be amended in writing upon the collective agreement of the authorized representatives of the Signatory States.

[SIGNATURES ON NEXT PAGES]

USEFUL ACRONYMS

AFTS	American Farm Tree System
AMPs	Acceptable Management Practices
ANR	Agency of Natural Resources
BAF	Biogenic Accounting Factor
BAP	Biomass Action Plan
BERC	Biomass Energy Resource Center
Btu	British Thermal Units
CAA	Clean Air Act
CEP	2011 Vermont Comprehensive Energy Plan
CHP	Combined Heat and Power
CLC	Commission on Land Conservation
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CoC	Chain of Custody
CPG	Certificate of Public Good
CWA	Clean Water Act
DBH	Diameter at Breast Height
DECC	Department of Energy and Climate Change
DNREC	[Delaware] Department of Natural Resources and Environmental Conservation
DOER	Massachusetts Department of Energy Resources
DOE	U.S. Department of Energy
DWM	Down woody material
EIA	U.S. Energy Information Agency

EPA	U.S. Environmental Protection Agency
EU	European Union
FLEGT	Forest Law Enforcement, Governance and Trade
FSC	Sustainable Forestry Initiative
GHG	Greenhouse Gases
GIS	Generation Information System
GREC	Gainesville Renewable Energy Center
HFRA	Healthy Forest Restoration Act of 2003
IPCC	Intergovernmental Panel on Climate Change
KW	Kilowatts
KWh	Kilowatt Hours
LEAP	Logger Education to Advance Professionalism
LEED	Leadership in Energy and Environmental Design
Mg/ha	Milligrams per hectare
mmBTU	Million British Thermal Units
MMt	Million Metric Tons
MoU	Memorandum of Understanding
MP C&I	Montreal Process Criteria and Indicators
MUSYA	Multiple-Use Sustained Yield Act of 1960
MW	Megawatts
MWh	Megawatt Hours
NALG	Net Available Low-grade Growth
NEGC	New England Governor's Conference
NESCOE	New England State Committee on Electricity

NEPOOL	New England Power Pool
NFMA	National Forest Management Act of 1976
NGO	Non-governmental Organization
NOx	Nitrogen Oxide
NSSEP	North Springfield Sustainable Energy Project
PSB	Public Service Board
PSD	Prevention of Significant Deterioration
PUC	Public Utilities Commission
REC	Renewable Energy Credit
RFS	Renewable Fuel Standards
RGGI	Regional Greenhouse Gas Initiative
RHI	Renewable Heat Initiative
RPS	Renewable Portfolio Standard
SFM	Sustainable Forest Management
SPEED	Sustainably Priced Energy Enterprise Development
TMDL	Total Maximum Daily Load
TREC	Thermal Renewable Energy Credit
USDA	U.S. Department of Agriculture
VT FPR	Vermont's Department of Forests, Parks, and Recreation
VT PSD	Vermont Public Service Department

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