MURTHA

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November 30, 2009

VIA HAND DELIVERY

Mr. S. Derek Phelps
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: NRG Energy, Inc. Responses to Connecticut Siting Council Interrogatories; Docket No. 907

Dear Mr. Phelps:

I write on behalf of NRG Energy, Inc. ("NRG") and Montville Power LLC ("MPL") to provide the Connecticut Siting Council (the "Council") with MPL's responses to the Council's second set of interrogatories. In addition, in an e-mail dated November 24, 2009, Mr. Robert Mercier asked for an update regarding NRG's Petition for a Declaratory Ruling from the Connecticut Department of Public Utility Control ("DPUC") that the Montville biomass project qualifies as a Class I renewable energy source. The petition was the subject of Docket No. 09-03-12. On September 2, 2009, the DPUC issued its final decision that the project would qualify as a Class I renewable energy source if built and operated as proposed. A copy of the decision is attached.

Finally, MPL continues to work on the completion of the evaluation of the possible relocation of the fuel delivery facilities and expects to submit a report to the Council with the next two weeks.

If you have any questions, please feel free to contact me.

Sincerely,

Andrew W. Lord

Andrew W. Lord

Enclosures

cc: Jonathan Baylor, NRG
Julie L. Friedberg, Esq., NRG
Service List

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: In MPL's correspondence of October 15, 2009, several items are referenced without any sources listed. Please provide sources for the following:

(a) item #2 (fuel supply and sustainability) states "MPL has obtained information from fuel suppliers and a fuel study." Please provide the source of the fuel study.

(b) Item #2 (fuel supply and sustainability) states "these findings are consistent with supply studies conducted by the Connecticut Clean Energy Fund and the Massachusetts Division of Energy Resources." Please provide the sources of these studies.

(c) Item #2 (fuel supply and sustainability) states "...the Council can be assured that the fuel will be derived in a sustainable manner as required by state regulations to qualify for Class I Renewable Energy Credits (RECs)." Please cite the statutory and regulatory provisions.

RESPONSE: (a) MPL engaged Antares Group Incorporated ("Antares") to conduct a biomass fuel availability study. In conducting that study, Antares interviewed multiple suppliers and aggregators regarding their potential volumes, price, and fuel types.

(b) In 2005, the Connecticut Clean Energy Fund (the "CCEF") engaged Antares to conduct a fuel availability study entitled, *Fuel Supply Assessment for Waterbury and Plainfield Areas*. The report is available from CCEF.

In addition, the Massachusetts Division of Energy Resources engaged Innovative Natural Resource Solutions LLC, ("INRS") to analyze the fuel availability in western Massachusetts. INRS produced a report entitled *Biomass Availability Analysis – Five Counties of Western Massachusetts* (the "INRS Report"), which is attached. In addition to the results for the five counties that were evaluated, the INRS Report also included study results for 14 adjacent counties from which biomass fuel also would be

drawn. All counties studied for this report are within the proposed 100 mile fuel shed radius of Montville Station.

(c) The CCEF states on their website, "The term sustainable biomass has been defined in the Connecticut General Statutes Section16-1(a)(45) as biomass that is cultivated and harvested in a sustainable manner. "Sustainable biomass" can most likely be certified as a Class I renewable energy source and includes biomass that is cultivated and harvested in a sustainable manner, finished biomass products from sawmills, paper mills or stud mills, organic refuse fuel derived separately from municipal solid waste, or biomass from old growth timber stands. "Sustainable biomass does not include construction and demolition waste, as defined in Section 22a-208x of the Connecticut General Statutes ("C.G.S."). MPL does not intend to use construction and demolition waste as a fuel source. The Connecticut Department of Public Utility Control determined in Docket 09-03-12 that MPL's proposed conversion of Unit 5 to use biomass fuel would qualify as a Class I renewable energy source as defined in C.G.S. Section 16-1(a)(26).

C.G.S. Section16-1(a)(45) provides the following definition of "sustainable biomass":

"Sustainable biomass" means biomass that is cultivated and harvested in a sustainable manner. "Sustainable biomass" does not mean construction and demolition waste, as defined in section 22a-208x, finished biomass products from sawmills, paper mills or stud mills, organic refuse fuel derived separately from municipal solid waste, or biomass from old growth timber stands, except where (A) such biomass is used in a biomass gasification plant that received funding prior to May 1, 2006, from the Renewable Energy Investment Fund established pursuant to section 16-245n, or (B) the energy derived from such biomass is subject to a long-term power purchase contract pursuant to subdivision (2) of subsection (j) of section 16-244c entered into prior to May 1, 2006, (C) such biomass is used in a renewable energy facility that is certified as a Class I renewable energy source by the department until such time as the department certifies that any biomass gasification plant, as defined in subparagraph (A) of this subdivision, is operational and

accepting such biomass, in an amount not to exceed one hundred forty thousand tons annually, is used in a renewable energy facility that was certified as a Class I renewable energy source by the department prior to December 31, 2007, and uses biomass, including construction and demolition waste as defined in section 22a-208x, from a Connecticut-sited transfer station and volume-reduction facility that generated biomass during calendar year 2007 that was used during calendar year 2007 to generate Class I renewable energy certificates, or (D) in the event there is no facility as described in subparagraph (A) or (C) of this subdivision accepting such biomass, in an amount not to exceed one hundred forty thousand tons annually, is used in one or more other renewable energy facilities certified either as a Class I or Class II renewable energy source by the department, provided such facilities use biomass, including construction and demolition waste as defined in said section 22a-208x, from a Connecticut-sited transfer station and volume-reduction facility that generated biomass during calendar year 2007 that was used during calendar year 2007 to generate Class I renewable energy certificates. Notwithstanding the provisions of subparagraphs (C) and (D) of this subdivision, the amount of biomass specified in said subparagraphs shall not apply to a biomass gasification plant, as defined in subparagraph (A) of this subdivision.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: The hearing transcript of September 16, 2009, p. 27, MPL states high infrastructure costs would be associated with rail delivery. Were any studies conducted on the feasibility and/or costs associated with such delivery to the power station? If so, please provide. If not, what is the basis for this statement?

RESPONSE: Internal evaluations coupled with the Antares biomass fuel availability study referenced in the response to the preceding interrogatory did evaluate the infrastructure costs associated with rail delivery of biomass fuel. These studies contain market sensitive information related to fuel supply vendors and fuel prices that would provide an advantage to MPL's competitors if disclosed. However, with regard to rail delivery, the study indicates that rail delivery to Montville Station is logistically and economically impractical. To set up the site for biomass delivery, a new spur would need to be constructed in parallel with the existing line. The rail corridor through the site is bordered to the east by an embankment and the CL&P 345 & 115kV switchyard, and on the west by MPL's oil tank farm, proposed fuel barn and the CL&P 69kV switchyard. These structures would make it difficult to construct a parallel rail spur to facilitate car unloading.

Train cars that transport wood chips are designed either for rotary or bottom dumpers. Rotary dumpers are preferred in the industry because they have less maintenance costs associated with them and, if the chips were to freeze, a rotary dumper can still be unloaded, while the bottom dumper would need to be thawed.

Both rotary and bottom dumpers require a gravity-fed unloading system that would require elevations of approximately 30-35 feet for underground receptacle, surge bins and conveyors. The current rail corridor is at 14' above sea level, so significant modifications would be required to achieve the requisite height, such as building trestles, deep foundations below water table levels or cofferdams. In addition to this, the capital cost for traditional train unloading

facilities is significant and could increase costs of the project by more than 20%.

The most significant challenge with train delivery is the associated transportation cost. The upfront costs to lease rail cars are significantly greater than truck delivery which quickly deteriorates rail's fuel cost advantages for transportation within 100 miles. The cost to deliver biomass wood chips by rail would exceed the FOB price of chips by approximately 160%. This cost includes the cost of delivery of the chips from the woods to the train loading depot, the per-car charge for usage, and the subsequent fuel surcharge for rail delivery.

In addition to the environmental benefits attendant to the conversion of Montville Station Unit 5 to greenwood biomass, the fuel switch lowers the Unit's production cost so significantly that it transforms a very low capacity factor generating unit into a base load unit. By operating more frequently at a lower cost, the biomass process generates net revenues sufficient to justify the capital investment associated with the project. If the project's fuel costs were to increase by 160%, then the project's wholesale market competitiveness would decrease and provide insufficient opportunity to recover fixed costs. Moreover, the high cost of the necessary modifications to accommodate rail delivery further diminish the project's economic viability.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: The application states that barge delivery is possible from wood fuel sources located in northern states. Were any studies conducted on the feasibility and/or costs associated with such delivery to the power station? If so, please provide. If not, what is the basis for this statement.

RESPONSE: Internal evaluations coupled with the Antares biomass fuel availability study referenced in previous responses did evaluate the infrastructure costs associated with barge delivery of biomass fuel. These studies contain market sensitive information related to fuel supply vendors and fuel prices that would provide an advantage to MPL's competitors if disclosed. Like rail delivery, barge delivery to Montville Station is logistically and economically impractical. Major modifications would be required to receive biomass fuel by barge. Hydraulic cranes, unloading surge bins and additional conveyor systems would be required for barge delivery capabilities. Similar systems would also be required for truck receiving, handling, storage and loading at the barge origination port, which would effectively duplicate the receiving operations by having identical receiving and storage capabilities at the Montville site and at the barge loading facility. The capital cost to construct loading/unloading facilities would increase the project's capital cost by approximately $10 million.

Like rail delivery, the most significant issue with barge delivery is the associated transportation cost. Daily charges for barge use, tugboat services, fuel surcharges and throughput charges from the loading port increase the price of FOB fuel by 95%. Hence, barge delivery is a viable delivery option only when receiving fuel from distances greater than a 100 mile radius. Ultimately, truck delivered fuel from within a 100 mile radius is by far the most standard and economical delivery method when compared to other modes of transport.

Rail and barge are more economical for shipping coal than wood because coal has a weight density about 2.5 times greater than wood. The limitation on barge and rail car

delivery is how much fuel can fit on rail cars and barge, it is not necessarily a weight limitation. Since rail and barge can transport fewer BTU to the project site, relative to coal, the per-unit cost is much greater and escalates fuel costs significantly.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: Does MPL intend to construct unloading infrastructure associated with barge delivery as part of this project? If so, provide plans. If not, why not.

RESPONSE: Based on the information provided above, MPL does not currently intend to construct barge unloading facilities associated with the biomass project.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: Please explain the feasibility of delivering fuel by truck to an off-site location for unloading and hogging, then shipping the processed fuel to the plant by barge or rail. Were any studies conducted on the costs of such delivery?

RESPONSE: Fuel received by MPL already will have been processed to designed specifications by suppliers at their off-site locations. MPL will not process whole wood for size reduction on site. Due to the layout and design of the plant only pre-processed, chipped products will be able to be received. The only processing equipment at Montville Station will be used to reduce an anticipated small for amount of chips that are received as over-sized material (>3").

Because the fuel is processed remotely, most of the chips will fit within the design specifications. However, there are some chips that may run through suppliers' chippers that are irregular in size. The industry standard process design for biomass plants is to have additional size reduction on-site for any chips that have passed through processing machinery but may still exceed design specifications.

Delivery of the biomass to an off-site location and then the subsequent loading and shipping of the material to Montville Station would involve a "double handling" of the fuel. Costs associated with this double handling is estimated to increase the cost of delivered fuel another 20% above the expected delivered price of fuel (44% of FOB price).

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: Please explain the feasibility of truck access to the site from Dock Road either along the CL&P right-of-way or along the existing railroad line.

RESPONSE: For safety and line maintenance purposes, MPL has not engaged CL&P in discussions with regard to constructing a road underneath its high-voltage power lines. Access along the railroad line would not be feasible due to the limited space along the line.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: Please explain the feasibility of truck access to the site from Hewitt Drive and the adjacent CL&P right-of-way.

RESPONSE: See Response to Question 2-6.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: Does MPL intend to obtain fuel from a 100-mile radius? If so, at what truck fuel cost is this radius no longer cost effective? Is there enough wood fuel within a 50 mile radius? If so, at what truck fuel cost is this radius no longer cost effective?

RESPONSE: MPL has studied fuel availability within both a 50 and a 100 mile fuel radius. Sufficient fuel is available within a 100 mile radius. Biomass fuel is typically sourced from the closest suppliers, moving further out as necessary. MPL expects the majority of fuel will originate within a 50 mile radius of the plant, however, MPL expects that some fuel may travel within 100 miles.

Truck transport is typically expected to increase FOB prices by approximately 20-25%, compared to increases of 160% for rail and 95% for barge. All three transportation options use diesel fuel for delivery, so any increase in diesel prices will be realized in all three delivery options. However, if diesel prices today are $2.50 per gallon, then a reasonable diesel fuel price at which trucking costs would be equal to rail or barge options would range between $13 per gallon at 100 miles and $30 per gallon for 50 miles.

Witnesses: Jonathan Baylor

Request from: CSC

QUESTION: Is it possible that other generator units at the site would be converted to wood fuel in the near term? Please explain.

RESPONSE: MPL does not plan to convert the remaining generator units at the site to biomass. Units 10 and 11 are diesel-fired combustions engines and cannot be converted to biomass. Conversion of Montville Station Unit 6, a 410 MW oil-fired steam unit, would require a fuel shed, fuel unloading system, and fuel storage area several magnitudes larger than what is required for Unit 5 and therefore is not economically feasible.

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC UTILITY CONTROL
TEN FRANKLIN SQUARE
NEW BRITAIN, CT 06051

DOCKET NO. 09-03-12 PETITION OF NRG ENERGY, INC. FOR A DECLARATORY RULING THAT THE MONTVILLE BIOMASS PROJECT WILL QUALIFY AS A CLASS I RENEWABLE ENERGY SOURCE

September 2, 2009

By the following Commissioners:

John W. Betkoski, III
Anthony J. Palermino
Amalia Vazquez Bzdyra

DECISION

I. INTRODUCTION

A. SUMMARY

In this Declatory Ruling, the Department of Public Utility Control determines that NRG Energy, Inc.'s Unit 5 at the Montville Station electric generating plant in Uncasville, Connecticut would qualify as a Class I renewable energy resource if built and operated as proposed in its Petition and if NRG can comply with the Department's generation and emission tracking requirements.

B. BACKGROUND OF THE PROCEEDING

By Petition received March 25, 2009 (Petition), NRG Energy, Inc. (NRG) requests that the Department of Public Utility Control (Department) issue a Declatory Ruling that NRG's Unit #5 if converted to burn sustainable biomass as its primary fuel to generate 35 MW of clean, renewable power at the Montville Station generating facility, (Facility) located in Uncasville, Connecticut, would qualify as a Class I renewable energy source as defined in the General Statutes of Connecticut (Conn. Gen. Stat.) § 16-1(a)(26).

C. CONDUCT OF THE PROCEEDING

A hearing in this matter is not required and none was held.

D. PARTIES

The Department recognized NRG Energy, Inc. (Represented by Murtha Cullina LLP), City Place I, 185 Asylum Street, 29th Floor, Hartford, Connecticut 06103-3469; and the Office of Consumer Counsel (OCC), Ten Franklin Square, New Britain, Connecticut 06051, as Parties to this proceeding.

II. PETITIONER'S EVIDENCE

A. PROJECT DESCRIPTION

Unit 5 of the Montville Station is located on the Thames River, six miles north of New London in Uncasville, Connecticut. Montville Station is a 500 MW peaking facility comprised of four generating units known as Units 5, 6, 10, and 11. Unit 5 was placed in service in the 1950's. Unit 5 is an 82 MW steam generation unit presently fueled by natural gas and No. 6 oil. NRG plans to retrofit Unit 5 to burn clean wood biomass to produce 35 MW of renewable energy. The Montville Biomass Project will be designed to allow Unit 5 to also operate on natural gas or ultra low sulfur distillate at its full 82 MW capacity when needed to provide power during peak periods. Petition, pp. 1 and 2. The design allows NRG to measure and track fuel sources by time and date. NRG will track all fuel usage internally by fuel type and file monthly fuel consumption reports with the Energy Information Administration (EIA) under form EIA-923. These reports may be publicly released, with the exception of pricing information. Using information filed with the EIA, NRG will be able to provide quarterly reports to the DPUC detailing fuel usage by type. Responses to Interrogatory EL-2.

NRG plans to procure the biomass fuel supply to power Unit 5 from local Connecticut sources, including foresters. The facility's location on the estuarine portion of the Thames River also affords NRG the option to transport sustainable biomass by barge from the northern states. The biomass fuel source will consist exclusively of untreated wood, urban wood wastes, and forest residues.

Unit 5, as retrofitted, will utilize a stoker technology with a vibrating grate feed system that will allow the biomass to be evenly combusted with increased efficiency and lower ash discharge. NRG will install emission controls to attain the Lowest Achievable

Emissions Rate (LAER) for nitrogen oxides (NOx) emitted from Unit 5. The NOx emissions from the Montville Biomass Project will be lower than the statutory Class I criterion of .075 pounds per million BTU (MMBTU) and will compare favorably to the emission profiles of other biomass plants in the state. The project is expected to become operational in mid-year 2011. Petition, pp. 1 and 2.

B. WOOD FUEL

NRG's proposed biomass facility will primarily utilize biomass fuel from three source streams:

1. Untreated recycled wood from manufacturing residues: includes sawdust, shavings, and unused wood from wood manufacturing and milling businesses (*e.g.* saw mills or flooring mills).

2. Urban wood wastes: includes land-clearing debris from home and business development, residential yard wastes from arborists and landscaping activities, and untreated recycled pallets.

3. Forest residues: includes logging residues, land-clearing debris from timber stand improvements and commercial development removals. Forest residues are typically whole tree chips and unmerchantable byproducts of normal timbering practices, including trunks, limbs, stumps, leaves, and tree tops. Unmerchantable biomass products are traditionally left on the forest floor while high-value saw timber is sold to lumber markets.

Under no circumstances will NRG accept painted, stained, pressure-treated or engineered material or any other construction or demolition waste for use as a biomass fuel for Unit 5. Petition, pp. 4 and 5.

III. DEPARTMENT ANALYSIS

A. STATUTORY REQUIREMENTS

Conn. Gen. Stat. § 16-1(a)(26) defines a Class I renewable energy source, in part, as:

> (A) energy derived from . . . a sustainable biomass facility with an 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 . . .

Conn. Gen. Stat. § 16-1(a)(45) defines "Sustainable Biomass", in part, as:

> Biomass that is cultivated and harvested in a sustainable manner. "Sustainable biomass" does not mean construction and demolition waste, as defined in section 22a-208x, finished biomass products from sawmills, paper mills or stud mills, organic refuse fuel derived separately from municipal solid waste, or biomass from old growth timber stands . . .

B. WOOD FUEL

According to NRG, the Facility will use biomass that is cultivated and harvested in a sustainable manner such as chipped trees, stumps, branches, brush, whole tree chips and bark, fallen trees, waste wood and limbs. Petition, p. 5. Conn. Agencies Regs. §22a-208a-1(19) defines "land clearing debris" as "trees, stumps, branches, or other wood generated from clearing land for commercial or residential development, road construction, routine landscaping, agricultural land clearing, storms, or natural disasters." NRG stated that the wood fuel it would use originates from local Connecticut sources. As such, the Department finds that the aforementioned wood fuel used by NRG qualifies as "land clearing debris" as defined in statute. In Docket No. 06-06-14, Petition of Recycled Energy LLC for a Declaratory Ruling as to Whether "Land Clearing Debris" or "Processed C&D Wood" Qualifies as "Sustainable Biomass" as Defined in C.G.S. §16-a(a)(45) (Recycled Energy), the Department ruled that "land clearing debris" qualifies as a "sustainable biomass" as defined in Conn. Gen. Stat. § 16-1(a)(45). Therefore, the Department finds that the wood fuel used by NRG qualifies as sustainable biomass.

NRG stated that it will also burn sawdust, shavings and unused wood from wood manufacturing and milling businesses. Petition, p. 4. NRG shall not accept materials painted, stained, pressure-treated or engineered material or any other construction or demolition waste for use as a biomass fuel.

The Department finds that the sources of wood fuel proposed by the applicant would qualify as "clean wood" as that term is defined in state statutes. Furthermore, the Department finds that as these sources are not "treated" and therefore, are not "finished biomass products," that are excluded from the definition of "sustainable biomass." Further, these "clean wood" fuels result from timber industry cuttings that are cultivated and harvested in a sustainable manner.

Based on the foregoing, the Department finds that NRG's fuel sources would qualify as "sustainable biomass" as defined in Conn. Gen. Stat. § 16-1(a)(45).

C. NATURAL GAS/DISTILLATE

The project will be designed to to allow Unit 5 to also operate on natural gas or ULSD at its full capacity when needed to provide power during peak periods. These fuel sources are not sustainable biomass resources, but may be utilized for the limited purpose of providing power during peak periods when the unit's full capacity is needed.

The Department will only allow kilowatt hours produced from biomass generation for meeting the requirements to qualify as a Class I resource. There will be no proration allowed, and Unit 5 may earn RECs only when using biomass exclusively.

E. EMISSIONS STANDARD

Additionally, Class I eligible biomass facilities must clearly meet the average emissions rate criteria of equal to or less than .075 pounds of nitrogen oxides per million BTU of heat input on a quarterly basis to be classified as a Class I renewable resource. Conn. Gen. Stat. § 16-1(a)(26). NRG's proposed generation unit has not yet yielded any actual quarterly emissions data and, therefore, the emissions associated with the proposed generating unit are unknown at this time. Although the proposed pollution controls are intended to keep NRG's emissions of NOx to .075 lb/MMBtu or less, NRG must produce quarterly emissions reports to verify it meets the average emissions rate criteria of a Class I renewable energy source.

The Department will require NRG to track production, output, and emissions specific to Unit 5. It is these unit specific reports that the Department will use to determine if the Montville Biomass Project qualifies as a Class I Renewable Energy Source as the Department will only allow kilowatt hours produced from biomass generation and their measured emissions for meeting the requirements.

IV. FINDINGS OF FACT

1. Montville Station Unit 5 is a proposed biomass facility to be located in Uncasville, Connecticut.

2. NRG proposes to begin operations at Montville Station Unit 5 in mid-year 2011.

3. Montville Station Unit 5 is currently owned by NRG Energy, Inc.

4. Montville Station Unit 5 will operate as a biomass facility with a nameplate capacity of 35 MW.

5. Montville Station Unit 5 is connected to the ISO-NE grid through the Connecticut Light and Power Company.

6. Montville Station Unit 5 will use chipped trees, stumps, branches, brush, whole tree chips and bark, fallen trees, waste wood and limbs and other clean wood that exhibits the characteristics of whole tree chips as fuel.

7. Montville Station Unit 5 will use fuel that originates primarily from the culling of brush, fallen trees, waste wood, limbs and tree tips from local Connecticut sources.

8. NRG indicates that the Facility will be designed to allow use of natural gas and ULSD at its full capacity of 82 MW when needed to provide power during peak periods.

9. Montville Station Unit 5 currently has no emissions data.

IV. CONCLUSION

Based upon the project as described herein, the Department finds that, as proposed, the Facility's fuel sources would qualify as "sustainable biomass" as defined under Conn. Gen. Stat. § 16-1(a)(45). However, considering the CT Renewable Portfolio Standard's statutory emissions requirements, the Department cannot determine at this time that the proposed unit would have its application approved without production data demonstrating compliance with the emissions requirements. If in the first quarter of operation, the proposed retrofitted Montville Station Unit 5 biomass facility, measured unit specific, meets the statutory emission rate, which is equal to or less than .075 pounds of NOx per million BTU of heat input, the petitioner should apply for a Class I registration at that time.

DOCKET NO. 09-03-12 PETITION OF NRG ENERGY, INC. FOR A DECLARATORY RULING THAT THE MONTVILLE BIOMASS PROJECT WILL QUALIFY AS A CLASS I RENEWABLE ENERGY SOURCE

This Decision is adopted by the following Commissioners:

John W. Betkoski, III

Anthony J. Palermino

Amalia Vazquez Bzdyra

CERTIFICATE OF SERVICE

The foregoing is a true and correct copy of the Decision issued by the Department of Public Utility Control, State of Connecticut, and was forwarded by Certified Mail to all parties of record in this proceeding on the date indicated.

K. Santopietro

Kimberley J. Santopietro
Executive Secretary
Department of Public Utility Control

September 3, 2009
Date

Biomass Availability Analysis – Five Counties of Western Massachusetts

Renewable Biomass from the Forests of Massachusetts

Prepared for the

Massachusetts Division of Energy Resources
&
Massachusetts Department of Conservation and Recreation

Massachusetts Sustainable Forest Bioenergy Initiative
Division of Energy Resources
Department of Conservation and Recreation

With Funding Provided by the
Massachusetts Technology Collaborative

January 2007

Prepared By:

Innovative Natural Resource Solutions LLC

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This material was prepared with financial support from the Massachusetts Technology Collaborative – Renewable Energy Trust. However, any opinions, findings, conclusions, or recommendations expressed are those of Innovative Natural Resource Solutions LLC, and do not necessarily reflect the views of the Massachusetts Technology Collaborative, the Renewable Energy Trust, the Massachusetts Division of Energy Resources or the Massachusetts Department of Conservation and Recreation, and do not constitute an endorsement of products or services mentioned.

The analysis contained in this report is based upon our best professional judgement and on sources of information that we believe to be reliable. However, no representation or warrenty is made by Innovative Natural Resource Solutions LLC as to the accuracy or completeness of any information contained herein. Nothing in this report is, or should be relied upon as, a promise or representation as to the future.

This report is part of a larger project, the Massachusetts Sustainable Forest Bienergy Initiative, that received funding from the U.S. Department of Energy. This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

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List of Figures & Tables

Executive Summary

Biomass fuel from a number of sources is available in the 5 western counties of Massachusetts. Biomass fuel potentially available from existing operations (residues) includes logging residues, byproduct from forest product manufacturers, wood from land clearing, and urban wood. In the core counties of western Massachusetts (Berkshire, Franklin, Hampshire, Hampden and Worcester) roughly 750,000 green tons of residues are available, or enough fuel to power a plant 50 to 60 MW in size.

By including the fourteen counties that buffer the core counties, the total residue volume increases to 3.9 million green tons available annually. This is enough fuel to power facilities totaling roughly 290 MW in size.

The forests of western Massachusetts and the counties that buffer them have forest growth that exceeds current harvest and mortality levels, and some of this growth is potentially available for biomass energy production. Assuming that half of net growth is available for biomass energy production, the five counties of Western Massachusetts have up to an additional 960,000 green tons of biomass available, or enough fuel for about 70 MW of biomass electricity generation. Including the fourteen counties that buffer the core counties, a total of up to 6.7 million green tons of biomass is available, or enough wood to fuel roughly 500 MW of biomass power.

A number of markets exist or are proposed for low-grade wood, including but not limited to biomass fuel, for the Massachusetts and the areas that Massachusetts suppliers can economically access. Within a four hour drivetime of Pittsfield, Springfield and Worcester, MA, there are three dozen active, idle or proposed facilities that use biomass, or low-grade wood that could be directed toward biomass energy production.

- Twenty operating facilities, with combined annual wood use of up to 11.1 million green tons;
- Five idle facilities, with combined annual wood use of a half million green tons;
- Nine publicly proposed facilities, in various stages of development, with total combined wood use of up to 4.7 million green tons.

In addition to these listed facilities, developers remain interested in Massachusetts and New England as sites for new biomass or wood-based bio-fuel facilities, and it is expected that more facilities will be proposed.

Region

This resource assessment identifies biomass fuel potentially available for the production of electricity, thermal energy or biomass-based liquid fuels. Biomass availability from a variety of sources is identified, including sustainable forestry, land clearing, sawmill residues, construction and demolition debris, agricultural residues and other sources.

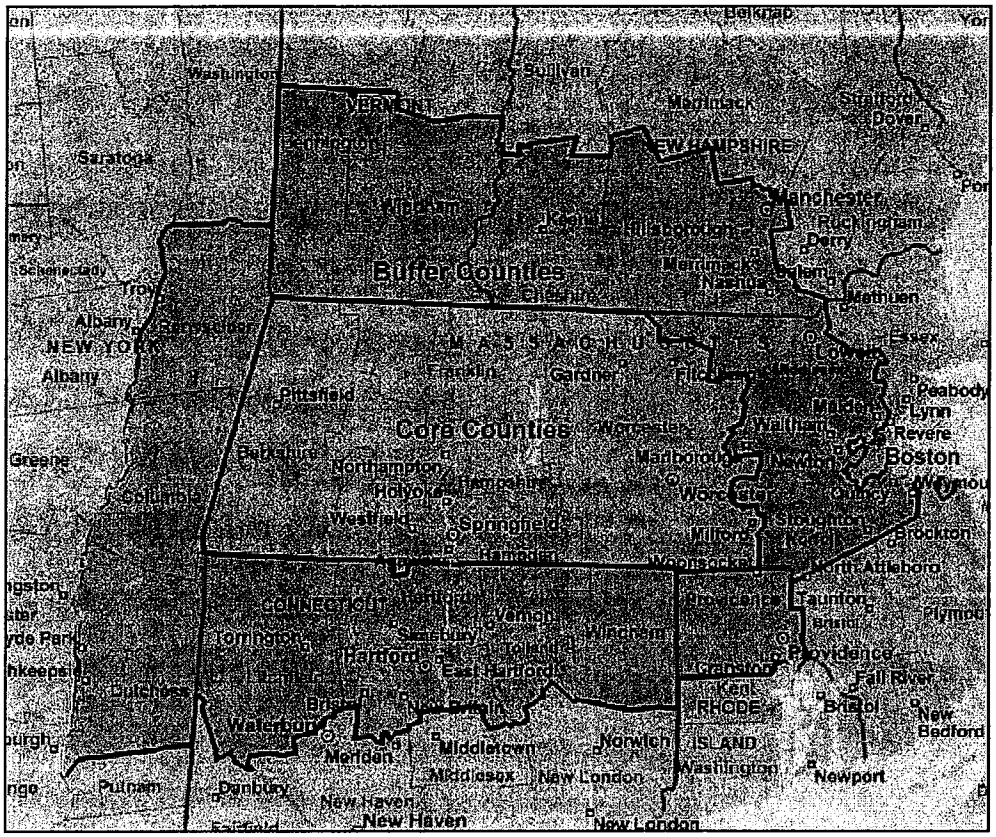
The focal area of this study is the counties of Western Massachusetts, shown in green in Figure 1 and referred to as the "core counties". These counties are the most heavily forested region of the state, and present an area with enhanced opportunities for biomass energy projects.

- Berkshire, MA
- Franklin, MA
- Hampden, MA
- Hampshire, MA
- Worcester, MA

However, because biomass is a fuel that trades freely across county and state lines, each county that directly abuts one of the core counties has been included in this analysis as well. These counties, are shown in blue in Figure 1, and referred to as "buffer counties":

- Hartford, CT
- Litchfield, CT
- Tollend, CT
- Windham, CT
- Middlesex, MA
- Norfolk, MA
- Cheshire, NH
- Hillsboro, NH
- Columbia, NY
- Dutchess, NY
- Rensselaer, NY
- Providence, RI
- Bennington, VT
- Windham, NY

Figure 1. Core and Buffer Counties



Forestland in the Region

The core counties have nearly 1.9 million acres of "timberland", or land that is capable of growing wood and where no legal prohibitions on harvesting exist. In the core and border counties, roughly 5.5 million acres of timberland exist. Of this land, the vast majority is in private ownership, with 54% of all land (87% timberland) owned by private individuals. The remaining land ownership is from state, municipal and county ownerships, though each is a relatively small portion of the land base[i].

Table 1 shows the acres of timberland and non-timberland, by ownership class. Table 2 shows this information, by percentage of total land, and Figure 2 provides a map showing percentage of timberland by county.

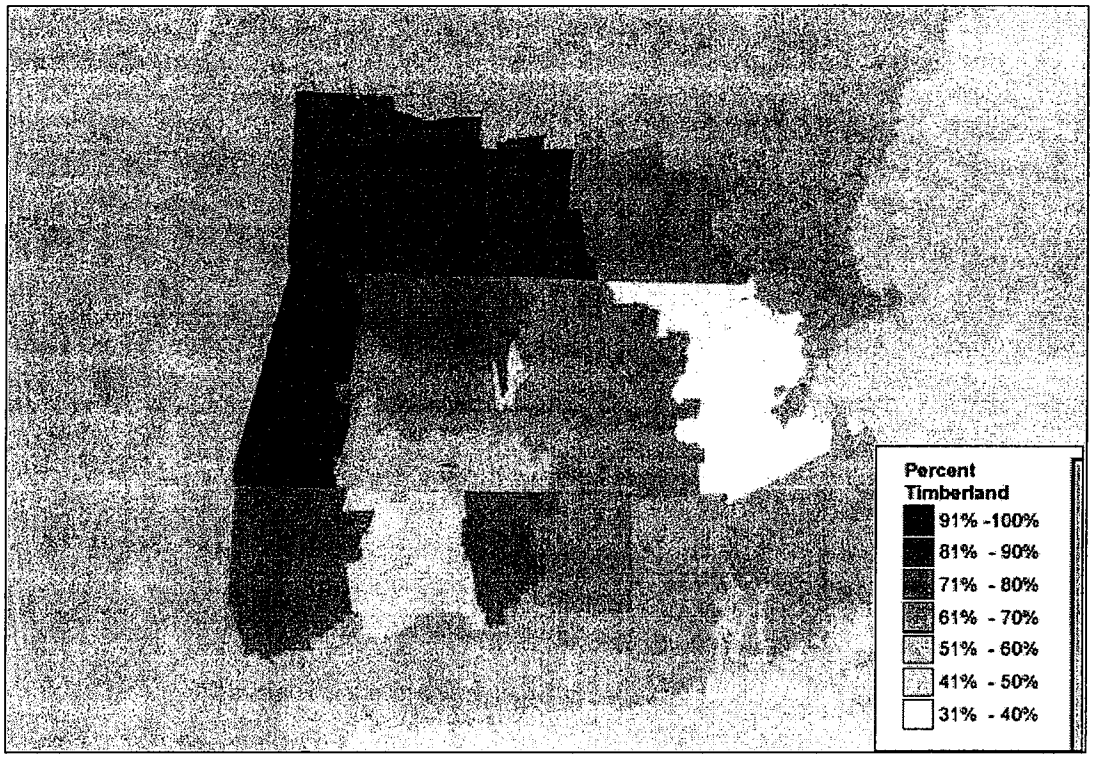
Table 1. Land Ownership in Core & Buffer Counties, by Acre

		Private	Municipal	State	Federal	All Timberland	All Land	Non-Timberland
				Acres				
Berkshire	MA	306,198	19,443	121,326	-	446,967	483,854	36,887
Franklin	MA	309,802	-	51,697	-	361,499	449,375	87,876
Hampden	MA	167,707	24,588	19,022	6,882	218,199	395,857	177,658
Hampshire	MA	205,341	4,994	27,551	-	237,886	338,574	100,688
Worcester	MA	477,236	26,571	71,202	18,071	593,080	968,430	375,350
Core Total		*1,466,284*	*75,596*	*290,798*	*24,953*	*1,857,631*	*2,636,090*	*778,459*
Hartford	CT	155,560	36,282	38,603	-	230,445	470,720	240,275
Litchfield	CT	387,167	26,482	12,897	-	426,546	588,809	162,263
Tolland	CT	144,266	7,069	27,571	-	178,906	246,451	67,545
Windham	CT	178,272	-	20,300	-	198,572	328,191	129,619
Middlesex	MA	124,690	16,502	24,670	-	165,862	527,073	361,211
Norfolk	MA	77,554	11,768	-	-	89,322	255,744	166,422
Cheshire	NH	314,014	39,324	6,214	6,671	366,223	452,775	86,552
Hillsborough	NH	361,529	16,459	4,963	-	382,951	560,947	177,996
Columbia	NY	223,299	-	5,234	-	228,533	400,763	172,230
Dutchess	NY	249,461	4,919	10,444	-	264,824	513,460	248,636
Rensselaer	NY	248,384	-	-	-	248,384	422,527	174,143
Providence	RI	119,970	7,628	18,541	-	146,139	264,502	118,363
Bennington	VT	215,665	26,226	-	107,350	349,241	432,835	83,594
Windham	VT	403,876	6,545	-	20,067	430,488	504,818	74,330
Buffer Total		*3,203,707*	*199,204*	*169,437*	*134,088*	*3,706,436*	*5,969,615*	*2,263,179*
Total		4,669,991	274,800	460,235	159,041	5,564,067	8,605,705	3,041,638

Table 2. Land Ownership in Core & Buffer Counties, by Percentage

		Private	Municipal	State	Federal	All Timberland	All Land	Non-Timberland
		Percent						
Berkshire	MA	63%	4%	25%	0%	92%	n/a	8%
Franklin	MA	69%	0%	12%	0%	80%	n/a	20%
Hampden	MA	42%	6%	5%	2%	55%	n/a	45%
Hampshire	MA	61%	1%	8%	0%	70%	n/a	30%
Worcester	MA	49%	3%	7%	2%	61%	n/a	39%
Core Total		*56%*	*3%*	*11%*	*1%*	*70%*	n/a	*30%*
Hartford	CT	33%	8%	8%	0%	49%	n/a	51%
Litchfield	CT	66%	4%	2%	0%	72%	n/a	28%
Tolland	CT	59%	3%	11%	0%	73%	n/a	27%
Windham	CT	54%	0%	6%	0%	61%	n/a	39%
Middlesex	MA	24%	3%	5%	0%	31%	n/a	69%
Norfolk	MA	30%	5%	0%	0%	35%	n/a	65%
Cheshire	NH	69%	9%	1%	1%	81%	n/a	19%
Hillsborough	NH	64%	3%	1%	0%	68%	n/a	32%
Columbia	NY	56%	0%	1%	0%	57%	n/a	43%
Dutchess	NY	49%	1%	2%	0%	52%	n/a	48%
Rensselaer	NY	59%	0%	0%	0%	59%	n/a	41%
Providence	RI	45%	3%	7%	0%	55%	n/a	45%
Bennington	VT	50%	6%	0%	25%	81%	n/a	19%
Windham	VT	80%	1%	0%	4%	85%	n/a	15%
Buffer Total		*54%*	*3%*	*3%*	*2%*	*62%*	n/a	*38%*
Total		54%	3%	5%	2%	65%	n/a	35%

Figure 2. Percent of Timberland by County



Biomass Fuels

A number of potential sources of biomass exist in the region, from residue from existing logging jobs to chips from sawmill operations to wood derived from land clearing wood. Each type of biomass fuel has unique characteristics, including moisture content and Btu content (British thermal units, a measure of heat content). Table 3 details the *typical* moisture content and heating value of different fuel types.

Table 3. Characteristics of Biomass Fuels

Fuel	Moisture	BTU/lb	MMBtu/ton
Logging Residues	45%	4,625	9.25
Sawmill Chips	45%	4,625	9.25
Pallet Grindings	20%	6,600	13.2
Secondary Forest Product Residue	10%	7,425	14.85
Land Clearing	45%	4,625	9.25

As a rule of thumb, it takes about 1.7 green tons of wood (45% moisture content) to make 1 megawatt hour (MWH) of electricity using most existing technologies[ii]. Put differently, each megawatt of installed biomass electricity generation will use roughly 13,000 green tons (45% moisture content) of biomass fuel annually (assumes 90% capacity factor).

The availability of each of these types of wood is described in detail later in the report.

Annual Growth and Harvest Levels in the Region

With all current markets in place, in both the core and buffer counties, forest growth exceeds loss (removals and mortality combined); with softwoods and hardwood species showing significant net growth (see Table 4). In the core counties alone, there is almost one million green tons of wood (stem only, not tops and branches) that grow in excess of current loss rates. In the buffer counties, another 7.8 million green tons of wood grows in excess to harvest level. Subject to landowner decisions, this volume of wood is available to new industries (i.e., biomass power plants). Because of landowner constraints, access issues, economic availability, nutrient concerns and the need to harvest less than growth to address landscape-level forest sustainability concerns, INRS suggest that half of this wood be considered actually "available" to the marketplace.

Table 4. Annual Forest Growth and Harvest (Stem Only), Core & Buffer Counties[iii]

	Core Counties	Buffer Counties	Core & Buffer Counties
	Green tons		
Net Volume			
Softwood	39,463,580	59,130,147	98,593,727
Hardwood	87,156,774	167,298,816	254,455,589
Total	126,620,354	226,428,963	353,049,317
Growth			
Softwood	820,527	3,513,653	4,334,180
Hardwood	1,442,246	7,788,731	9,230,977
Total	2,262,774	11,302,383	13,565,157
Removals			
Softwood	187,060	744,959	932,020
Hardwood	586,404	1,652,905	2,239,310
Total	773,465	2,397,865	3,171,329
Growth Less Loss			
Softwood	633,467	2,768,694	3,402,161
Hardwood	855,842	6,135,825	6,991,667
Total	1,489,309	8,904,519	10,393,828

The USDA Forest Inventory and Analysis, used to develop the data in Table 4, accounts for only the merchantable stem of the tree – wood that could go to traditional roundwood markets like sawlogs, veneer, pulp or engineered wood products. While this wood, particularly the lower grades, is theoretically available for biomass, the branches and tops of a tree are potentially available as well. In the Northeastern U.S., it is estimated that for every ton of biomass contained in the stem of a tree, another 0.29 tons of biomass are contained in the branches and tops.[iv] Table 5 uses the assumption that for every green ton of biomass in the stem, another 0.29 green tons is available in the tops and branches.

Table 5. Annual Forest Growth and Harvest (including branches), Core & Buffer Counties[v]

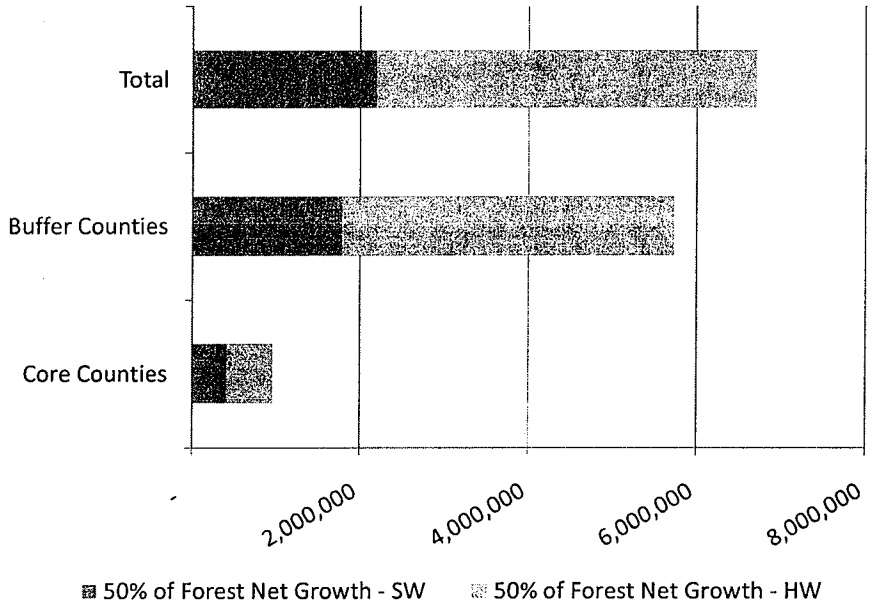
	Core Counties	Buffer Counties	Core & Buffer Counties
	Green tons		
Net Volume			
Softwood	50,908,018	76,277,890	127,185,908
Hardwood	112,432,238	215,815,472	328,247,710
Total	163,340,256	292,093,362	455,433,619
Growth			
Softwood	1,058,480	4,532,612	5,591,092
Hardwood	1,860,498	10,047,463	11,907,961
Total	2,918,978	14,580,075	17,499,053
Removals			
Softwood	241,308	960,997	1,202,305
Hardwood	756,462	2,132,248	2,888,710
Total	997,770	3,093,245	4,091,015
Growth Less Loss			
Softwood	817,173	3,571,615	4,388,787
Hardwood	1,104,036	7,915,215	9,019,251
Total	1,921,209	11,486,829	13,408,038

It is important to note that a considerable amount of the nutrients contained in a tree are in the tops (particularly when leaves are on), and removal of high volumes of this material from a logging job can raise concerns about long-term sustainability. For this reason, as well as practical availability, INRS recommends that availability of tops and branches be considered at no more than 50% of reported availability[vi]. Factors that limit full availability of biomass from forestland include:

- Landowner attitudes toward timber harvesting;
- Terrain (including proximity to roads, water bodies and vernal pools);
- Conservation or preservation of unique areas and special places;
- Limitations on the ability to economically gather all wood from a site; and
- Limitations on equipment (i.e., harvesting and processing equipment cannot capture all wood harvested).

Figure 3 shows the *potential* for net forest growth (including tops and branches) to serve as a biomass fuel, assuming that no more than 50% of this growth is harvested.

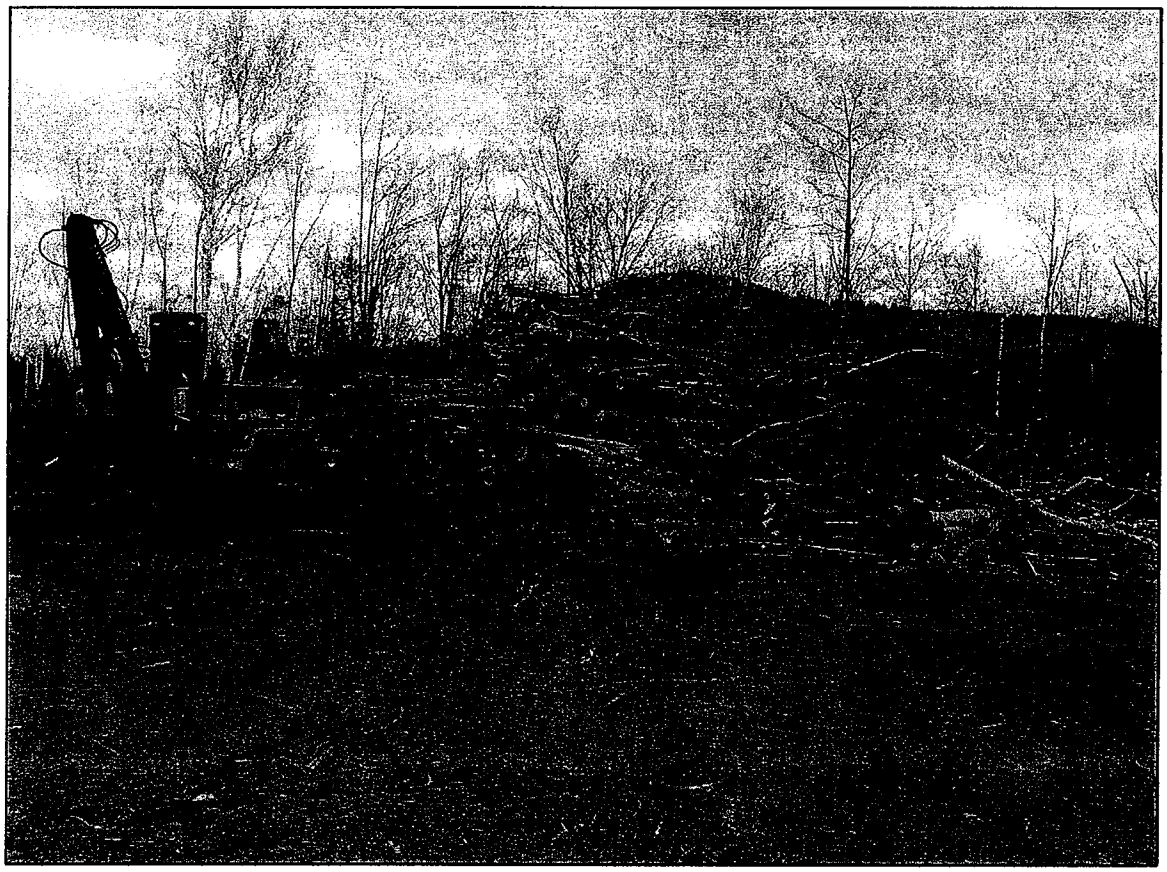
Figure 3. Potential Biomass Availability from Net Forest Growth, Green Tons



In practical terms, it is highly unlikely that this volume of wood could be harvested in an economic or environemtally responsible manner to supply biomass fuel. Further, some of this wood is sawlogs or other high-value material, and as such would be sent to other markets.

Figure 4 shows roundwood (front row) and hardwood tops from a log landing of a logging job in Southern New Hampshire. The tops and other wood not meeting pulpwood specifications were chipped for biomass fuel.

Figure 4. Roundwood and Tops Sorted on a New England Logging Job



Forest Harvest Residue

Forest harvest residue is wood that is left in the forest due to lack of market conditions. In most areas, this is tops, branches and pieces of tree that do not meet local specifications for sawlogs and pulpwood. Forest harvest residue is estimated to be roughly 110,000 green tons a year in the core counties, and 1 million green tons in the buffer counties[vii]. This is largely a function of existing harvesting activity – in locations with high volumes of existing logging activity, volumes of forest harvest residue tend to be higher. Table 6 shows annual harvest residue volumes by county[viii].

Table 6. Forest Harvest Residues (estimated)[ix]

State	County	forest residue green tons
Massachusetts	Berkshire	26,357
Massachusetts	Franklin	21,016
Massachusetts	Hampden	11,905
Massachusetts	Hampshire	19,423
Massachusetts	Worcester	30,668
Total - Core Counties		*109,369*
Connecticut	Hartford	5,113
Connecticut	Litchfield	28,035
Connecticut	Tolland	17,669
Connecticut	Windham	22,588
Massachusetts	Middlesex	10,460
Massachusetts	Norfolk	3,111
New Hampshire	Cheshire	648,000
New Hampshire	Hillsborough	125,004
New York	Columbia	24,745
New York	Dutchess	23,547
New York	Rensselaer	25,112
Rhode Island	Providence	5,856
Vermont	Bennington	9,402
Vermont	Windham	51,391
Total - Buffer Counties		*1,000,033*
Total - All Counties		1,109,402

Figure 5 and Figure 6 graphically display how the core and buffer counties compare in forest harvest residue volume, showing comparative volumes per square mile (Figure 5) and square mile (Figure 6).

Figure 5. Forest Harvest Residue, Core & Buffer Counties

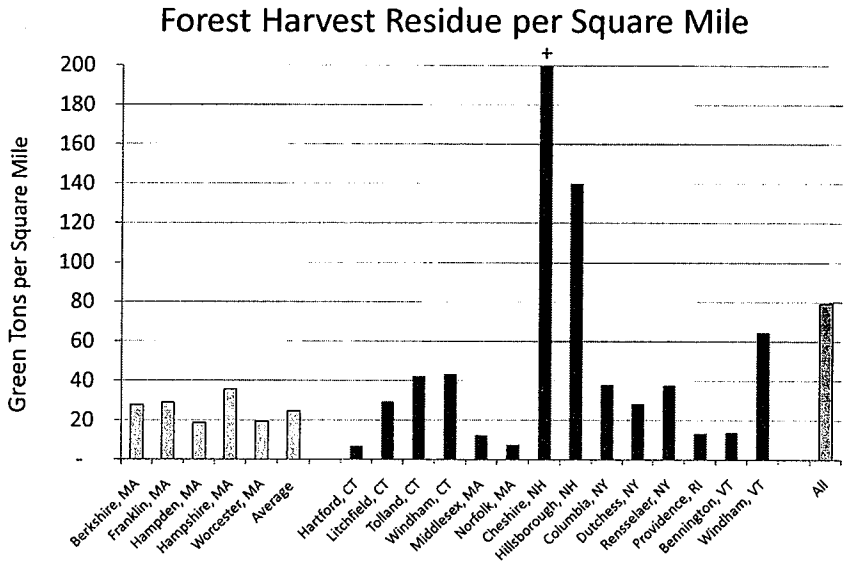
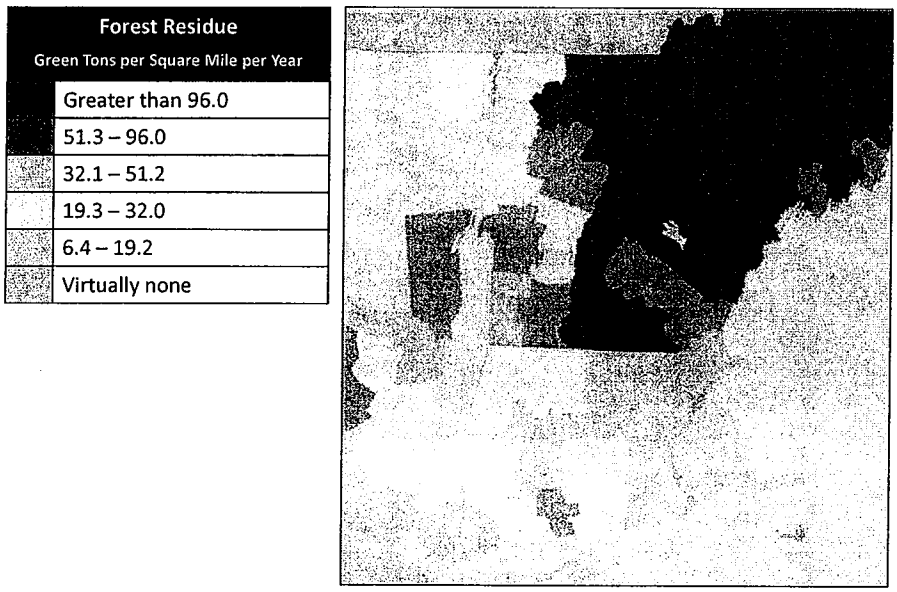


Figure 6. Forest Harvest Residues by County.



Sawmill Residue

When sawmills cut cylindrical logs into rectangular boards, residue is produced - including bark, sawdust and mill chips. Actual residue generation varies by species and mill equipment, but a general rule of thumb is that a log in a sawmill produces 60 to 70% of useful timber as boards, 20 to 30% as wood chips, and 10% as sawdust[x].

Based upon the latest USDA Forest Service Timber Product Output information (Table 7), sawmill residue (chips, bark and sawdust) in the region is roughly 150,000 green tons in the core counties, with another 700,000 green tons in the buffer counties.

Table 7. Sawmill Residue by County (estimated)[xi]

State	County	sawmill residue green tons
Massachusetts	Berkshire	36,108
Massachusetts	Franklin	15,692
Massachusetts	Hampden	27,788
Massachusetts	Hampshire	32,330
Massachusetts	Worcester	39,357
Total - Core Counties		*151,276*
Connecticut	Hartford	5,868
Connecticut	Litchfield	18,405
Connecticut	Tolland	10,105
Connecticut	Windham	31,154
Massachusetts	Middlesex	12,044
Massachusetts	Norfolk	-
New Hampshire	Cheshire	360,405
New Hampshire	Hillsborough	165,650
New York	Columbia	8,300
New York	Dutchess	31,187
New York	Rensselaer	19,624
Rhode Island	Providence	24,399
Vermont	Bennington	2,957
Vermont	Windham	15,808
Total - Buffer Counties		*705,906*
Total - All Counties		857,182

Sawmill residue, while a possible biomass fuel, has other potential uses as well. Bark is often sold for landscaping uses, sawdust is sold for pellet production or animal bedding, and sawmill chips are often sold to pulp mills. Most, if not all, sawmill residue generated in the core and buffer counties is presently sold to an existing market.

While critically important markets for locally harvested wood, it is important to note that the mills in Massachusetts are small by New England or national standards. As such, Massachusetts tends to have a smaller concentration of sawmill residue than some other regions in New England.

Figure 7 and Figure 8 graphically display how the core and buffer counties compare in forest harvest residue volume, showing comparative volumes per square mile (Figure 7) and square mile (Figure 8). Figure 9 shows sawmill residue (chips) being collected at a white pine sawmill.

Figure 7. Sawmill Residue, Core & Buffer Counties

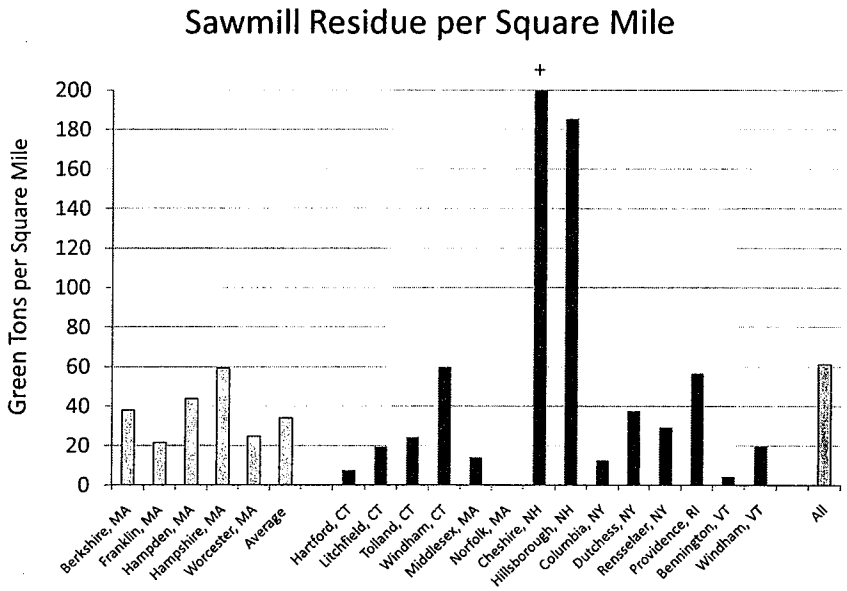


Figure 8. Sawmill Residue by County

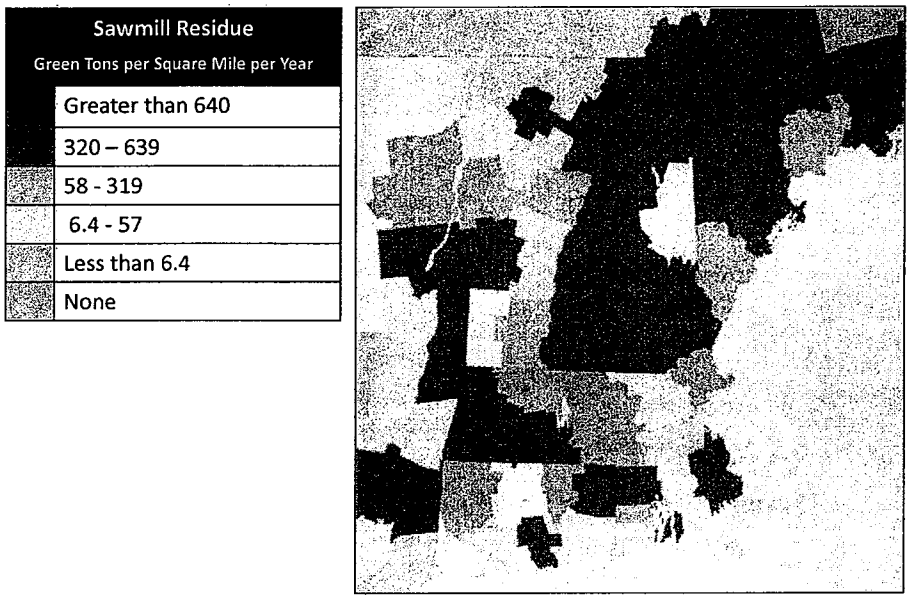
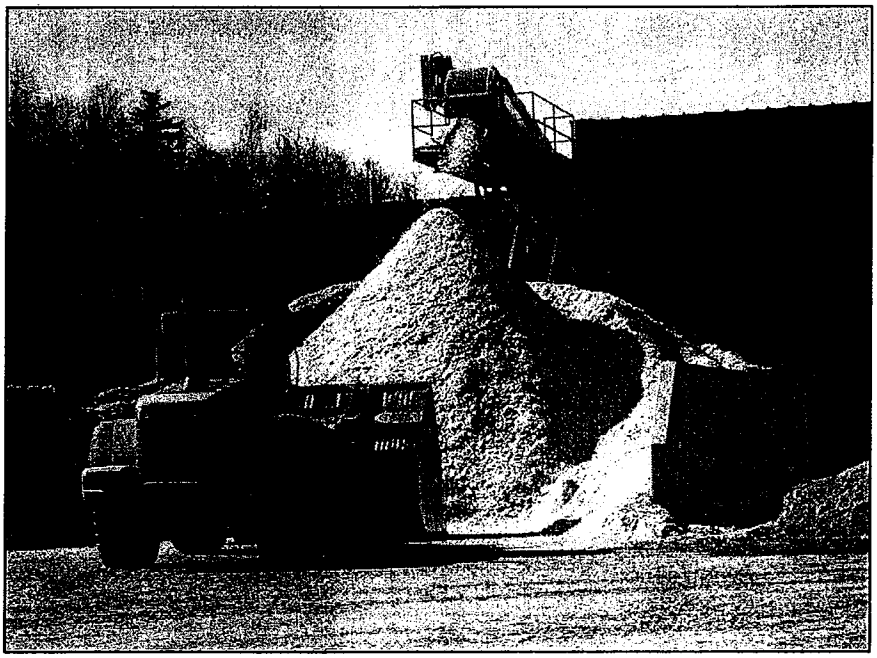


Figure 9. Residue Production at Sawmill



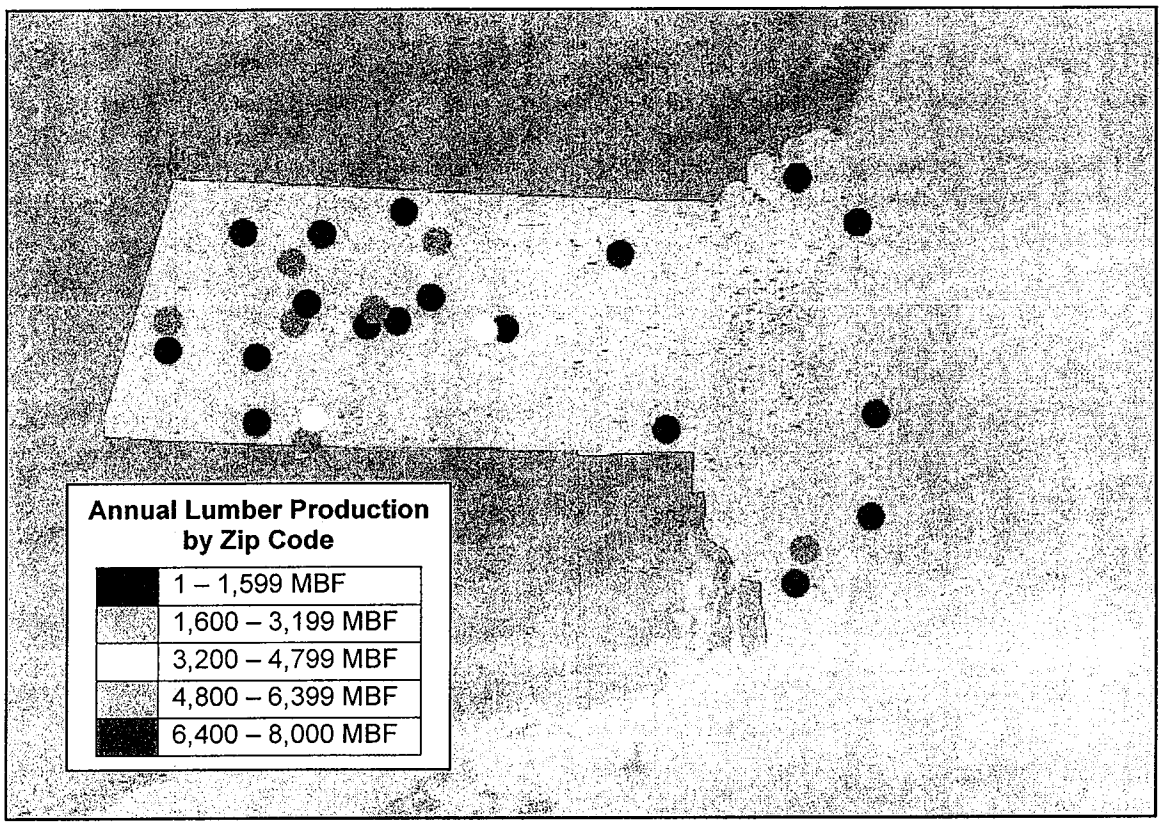
Sawmills in the western five counties of Massachusetts have a combined annual production estimated at almost 42,000 thousand board feet (Table 8). It is important to note that this production can vary annually due to closure and expansion of sawmills, market-related production, and changes in sawmill equipment used.

Table 8. Massachusetts Sawmill Production, Western Five Counties[xii]

Mill	Town	County	Production (MBF)
Harwood Bros. Lumber	Savoy	Berkshire	50
Ketchen Lumber	South Lee	Berkshire	100
Lenox Lumber Co.	Lenox	Berkshire	2,500
Muskrat Sawmill	East Freetown	Bristol	220
J.K. Delano Sawmill, Inc.	North Dartmouth	Bristol	350
Gurney's Sawmill Inc.	East Freetown	Bristol	1,700
Hicks Farm	Chalemont	Franklin	
Hall Tavern Farm	Shelburne Falls	Franklin	75
C&M Rough Cut Lumber	New Salem	Franklin	200
Northwoods Forest Products	Northfield	Franklin	220
Heyes Forest Products	Orange	Franklin	2,640
Roberts Bros. Lumber	Ashfield	Franklin	5,506
Renwood Lumber Co.	Southwick	Hampden	
Wackerbarth Box Shop	Granville	Hampden	600
Bannish Lumber Co.	Chester	Hampden	800
Great Brook Lumber Co.	Southwick	Hampden	2,000
Green Meadow Lumber Co.	Westfield	Hampden	4,700
Kicza Lumber Co.	Hadley	Hampshire	600
Wagner Wood	Amherst	Hampshire	900
WD Cowls Lumber Co.	Amherst	Hampshire	2,000
Lashway Forest Products	Williamsburg	Hampshire	
Berkshire Hardwoods	Chesterfield	Hampshire	4,800
Lashway Lumber Inc.	Williamsburg	Hampshire	8,000
Robinson Lumber	Wheelwright	Worcester	4,000
Total			*41,961*

Based upon previous work conducted by Innovative Natural Resource Solutions LLC[xiii], sawmills in this region of the country produce 1.05 to 1.50 green tons of sawmill chips per thousand board feet of lumber produced (does not include bark or sawdust residues). This provides a range of 44,000 to 63,000 green tons of production of mill chips, with actual production likely 57,000 green tons for the five counties[xiv]. Production of sawdust is calculated to be 29,000 green tons annually, and bark production about 65,000 green tons.

Figure 10. Sawmill Production by Zip Code



Secondary Forest Product Residue

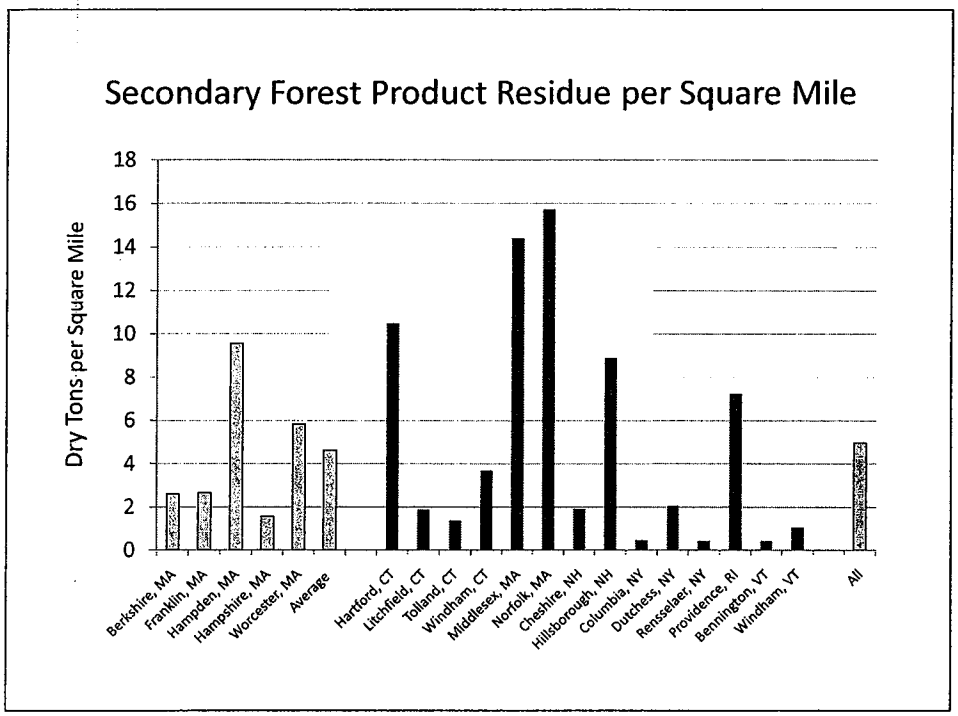
Secondary forest product residues are by-products of manufacturing consumer-ready material from lumber. Manufacturers that buy lumber (as contrasted with buying logs) and create a consumer-ready product – for example furniture, pallets, or factory-made housing – are secondary forest products industry. They generally do not buy wood directly from loggers, forester, or landowners. Instead, they rely upon sawmill and brokers, both local and distant, to provide lumber as a raw material to their manufacturing process. The residue created at these facilities – shavings, sawdust, chips, and cut-offs – is an excellent source of biomass fuel. Because the raw material is purchased as lumber, and is generally kiln-dried, secondary forest product residues are a low-moisture content fuel, and have a higher heating value per ton than green wood fuels.

Table 9. Secondary Forest Product Residue, by County[xv]

State	County	secondary mill dry tons
Massachusetts	Berkshire	2,469
Massachusetts	Franklin	1,931
Massachusetts	Hampden	6,067
Massachusetts	Hampshire	862
Massachusetts	Worcester	9,219
Total - Core Counties		*20,548*
Connecticut	Hartford	7,872
Connecticut	Litchfield	1,787
Connecticut	Tolland	579
Connecticut	Windham	1,926
Massachusetts	Middlesex	12,206
Massachusetts	Norfolk	6,440
New Hampshire	Cheshire	1,410
New Hampshire	Hillsborough	7,958
New York	Columbia	301
New York	Dutchess	1,711
New York	Rensselaer	296
Rhode Island	Providence	3,117
Vermont	Bennington	292
Vermont	Windham	862
Total - Buffer Counties		*46,756*
Total - All Counties		67,304

Because of its value as a biomass fuel, or as a feedstock for wood pellets, most of the secondary forest product residue in the region currently has a market.

Figure 11. Secondary Forest Product Residue, Core & Buffer Counties



Urban Wood Residues

Urban wood residues include most wood generated as a result of activity in and around urban and suburban areas, and include tree trimmings, utility right-of-way clearing, ground pallets, and the woody fraction of construction and demolition debris. Table 10 is presented in dry tons, as much of the wood (pallets and the woody fraction of construction & demolition debris) is delivered dry.

Table 10. Urban Wood Residues by County[xvi]

State	County	urban wood dry tons
Massachusetts	Berkshire	16,172
Massachusetts	Franklin	8,813
Massachusetts	Hampden	54,557
Massachusetts	Hampshire	18,106
Massachusetts	Worcester	88,822
Total - Core Counties		*186,470*
Connecticut	Hartford	103,207
Connecticut	Litchfield	22,094
Connecticut	Tolland	16,487
Connecticut	Windham	13,609
Massachusetts	Middlesex	174,346
Massachusetts	Norfolk	76,485
New Hampshire	Cheshire	8,280
New Hampshire	Hillsborough	41,952
New York	Columbia	7,521
New York	Dutchess	33,249
New York	Rensselaer	18,040
Rhode Island	Providence	71,424
Vermont	Bennington	4,196
Vermont	Windham	5,476
Total - Buffer Counties		*596,364*
Total - All Counties		782,834

Figure 12. Urban Wood Residues, Core & Buffer Counties

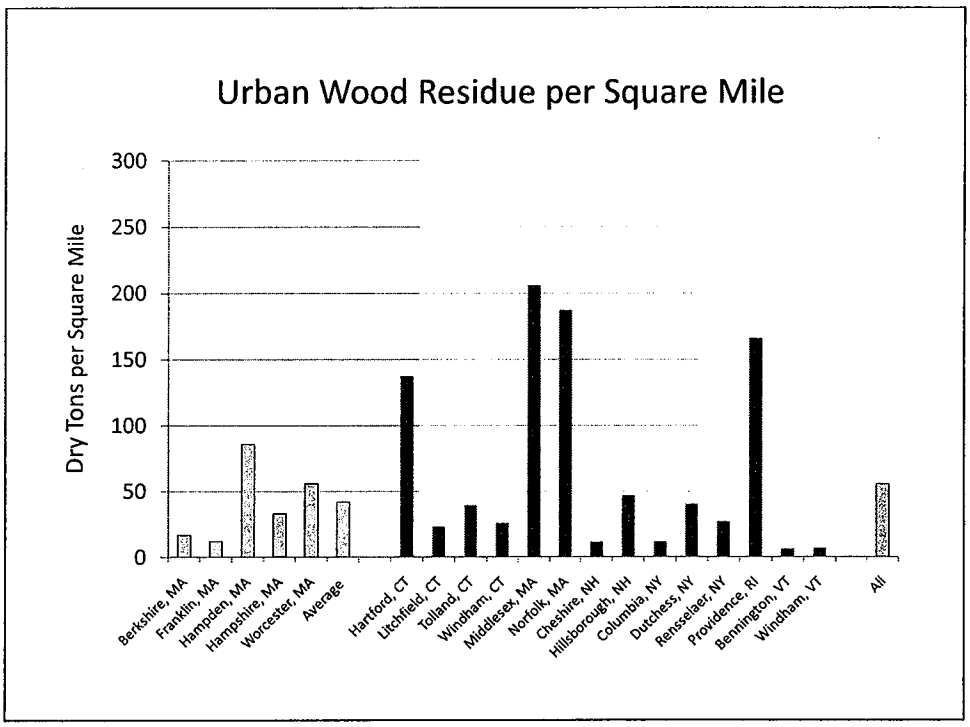


Figure 13. Urban Wood Residue by County

Urban Wood Residue Dry Tons per Square Mile per Year	
	Greater than 313
	83 - 313
	27 - 77
	6 – 26
	2 – 5.9
	Less than 2

Agricultural Residues

The region comprised of the core counties and buffer counties has very little agricultural crop residue that could be used as a biomass feedstock. While there are farms in this region, they tend to not be high-production operations that would generate high volumes of residue (corn stover, for example) in concentrations sufficient to justify the effort and investment required to gather the residue. Table 11 shows the practically available crop residues, by county. Agricultural residues are not an economically important biomass fuel in this region.

Table 11. Agricultural Residues by County[xvii]

State	County	crop residue dry tons
Massachusetts	Berkshire	-
Massachusetts	Franklin	-
Massachusetts	Hampden	-
Massachusetts	Hampshire	-
Massachusetts	Worcester	-
Total - Core Counties		-
Connecticut	Hartford	-
Connecticut	Litchfield	-
Connecticut	Tolland	-
Connecticut	Windham	-
Massachusetts	Middlesex	-
Massachusetts	Norfolk	-
New Hampshire	Cheshire	-
New Hampshire	Hillsborough	-
New York	Columbia	6,563
New York	Dutchess	4,777
New York	Rensselaer	7,191
Rhode Island	Providence	-
Vermont	Bennington	-
Vermont	Windham	-
Total - Buffer Counties		*18,531*
Total - All Counties		18,531

Land Clearing

Land clearing activity -- where forest is removed to make way for homes, roads, commercial buildings and other construction – is a significant source of biomass fuel. That is because when construction occurs, all or nearly all of the wood growing on the parcel must be removed. Based upon the average annual housing starts from 1999 - 2005, INRS has estimated the volume of wood that is likely to be available from land clearing, using USDA Forest Service information on the volume of wood on a typical parcel of land in each county, and assuming that 40% of the volume of wood removed is sent to either sawlog or pulpwood markets.

Table 12. Estimated Annual Volume of Biomass Fuel from Land Clearing[xviii]

		Annual Housing Starts	Green Tons per Year		
			Softwood	Hardwood	Total
Berkshire	MA	445	4,520	12,853	17,374
Franklin	MA	225	4,750	8,947	13,697
Hampden	MA	1,338	2,918	7,741	10,659
Hampshire	MA	561	2,799	7,091	9,890
Worcester	MA	4,295	9,162	16,428	25,590
Subtotal			*24,149*	*53,061*	*77,210*
Hartford	CT	3,477	1,639	10,005	11,644
Litchfield	CT	888	3,027	13,532	16,560
Tolland	CT	1,093	712	5,466	6,178
Windham	CT	552	1,520	5,626	7,146
Middlesex	MA	4,616	5,523	7,321	12,845
Norfolk	MA	1,939	2,818	3,787	6,605
Cheshire	NH	606	6,401	10,881	17,282
Hillsborough	NH	3,000	7,405	8,578	15,983
Columbia	NY	408	2,298	5,823	8,121
Dutchess	NY	1,667	548	9,421	9,969
Rensselear	NY	625	1,514	6,698	8,212
Providence	RI	1,922	682	4,501	5,184
Bennington	VT	325	1,080	9,424	10,504
Windham	VT	503	5,401	10,263	15,664
Subtotal			*40,568*	*111,328*	*151,896*
Total			64,717	164,389	229,106

Land clearing activity occurs all over Massachusetts and New England, but the activity is concentrated in the regions with the greatest suburban / semi-rural growth. In Massachusetts, this means that western regions of the state tend to have less land clearing wood available.

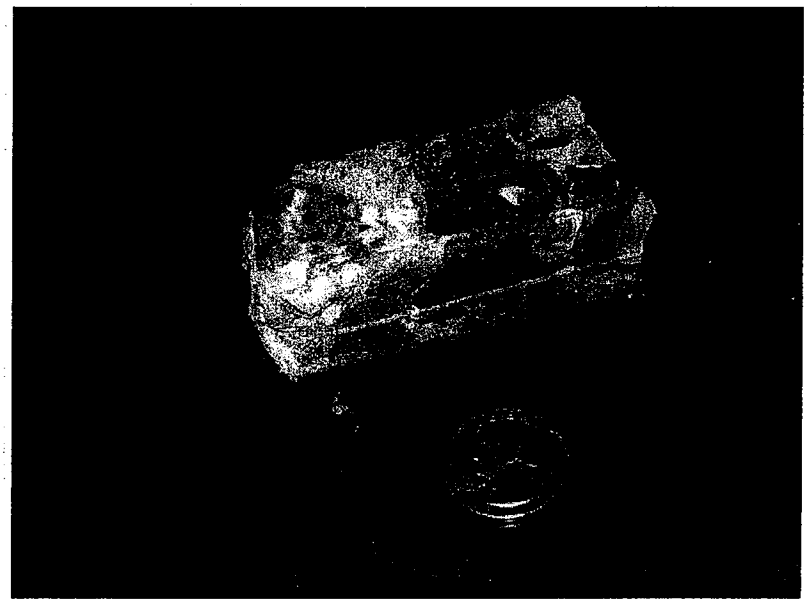
Biomass fuel derived from land clearing is not, at its core, a sustainable source of wood. The land that is cleared for construction will not grow trees again, and will not serve as part of the future wood basket for a biomass facility. That noted, land that is cleared for new development would be cleared with or without a biomass market – the use of wood as a fuel simply provides a useful outlet for what would otherwise be a waste product. The economics of biomass do not provide incentives for land clearing, but do allow land clearers to make use of their low-grade wood residues.

Figure 14. Annual Housing Starts per Square Mile, 1999 - 2005

Paper Cubes

"Paper Cubes" are a product that can be burned as a biomass fuel. This product consists of paper that is unable to be recycled, as well as coatings, clay and other fills found in paper. The cubes may also contain quantities of textiles, wood, and other combustible material. At this point, only one firm – International Paper Products of Westfield, MA – produces paper cubes for use in New England. Paper cubes are currently used as a fuel at Pinetree Power – Fitchburg (MA), and a number of current and proposed biomass facilities are exploring the use of paper cubes as a fuel.

Figure 15. Paper Cube from International Paper Products



Paper cubes, as now produced by International Paper Products in Westfield, MA, have between 17,000 and 20,000 mmbtu per ton. Of this, roughly half to two thirds is attributable to the paper content of the cube, the remainder can be attributed to coatings and other non-biomass components.

International Paper Products does not publicly disclose their production capabilities at their facility in Westfield, MA, and has indicated they would consider developing facilities in other locations if a raw material supply and stable market existed.

Biomass Energy Crops

The term "energy crop" refers to dedicated crops grown specifically for use in biomass energy production. For woody biomass in the Northeastern U.S., this likely refers to either willow or hybrid poplar. At this time, there is no known commercial-scale production of woody biomass energy crops in five counties of Western Massachusetts, or the adjacent counties.

Total Biomass Availability and Potential

Biomass residue available from existing forest harvesting activity, forest industry residues, urban wood residues and (limited) agricultural residues is equivalent to roughly 340,000 dry tons (629,000 green tons) in the core counties. The buffer counties have another 1.6 million dry tons (nearly 3 million green tons) of biomass residue available. The entire region, core and buffer counties, combines to have roughly 1.9 million dry tons (3.6 million green tons) of biomass fuel potentially available. Table 13 shows total biomass *residue* available by county.

Table 13. Total Biomass Residues by County[xix]

State	County	Total dry ton equivalent[xx]
Massachusetts	Berkshire	53,112
Massachusetts	Franklin	31,326
Massachusetts	Hampden	77,825
Massachusetts	Hampshire	47,073
Massachusetts	Worcester	129,732
Total - Core Counties		*339,068*
Connecticut	Hartford	107,364
Connecticut	Litchfield	49,065
Connecticut	Tolland	31,924
Connecticut	Windham	45,233
Massachusetts	Middlesex	182,675
Massachusetts	Norfolk	77,287
New Hampshire	Cheshire	604,977
New Hampshire	Hillsborough	213,781
New York	Columbia	32,808
New York	Dutchess	67,838
New York	Rensselaer	49,452
Rhode Island	Providence	84,897
Vermont	Bennington	11,468
Vermont	Windham	45,944
Total - Buffer Counties		*1,604,713*
Total – All Counties		1,943,781

Biomass availability is not uniform by county, and Figure 15 shows the concentration of biomass available, by square mile, for all core and buffer counties.

Figure 16. Total Biomass Residue Available, by County

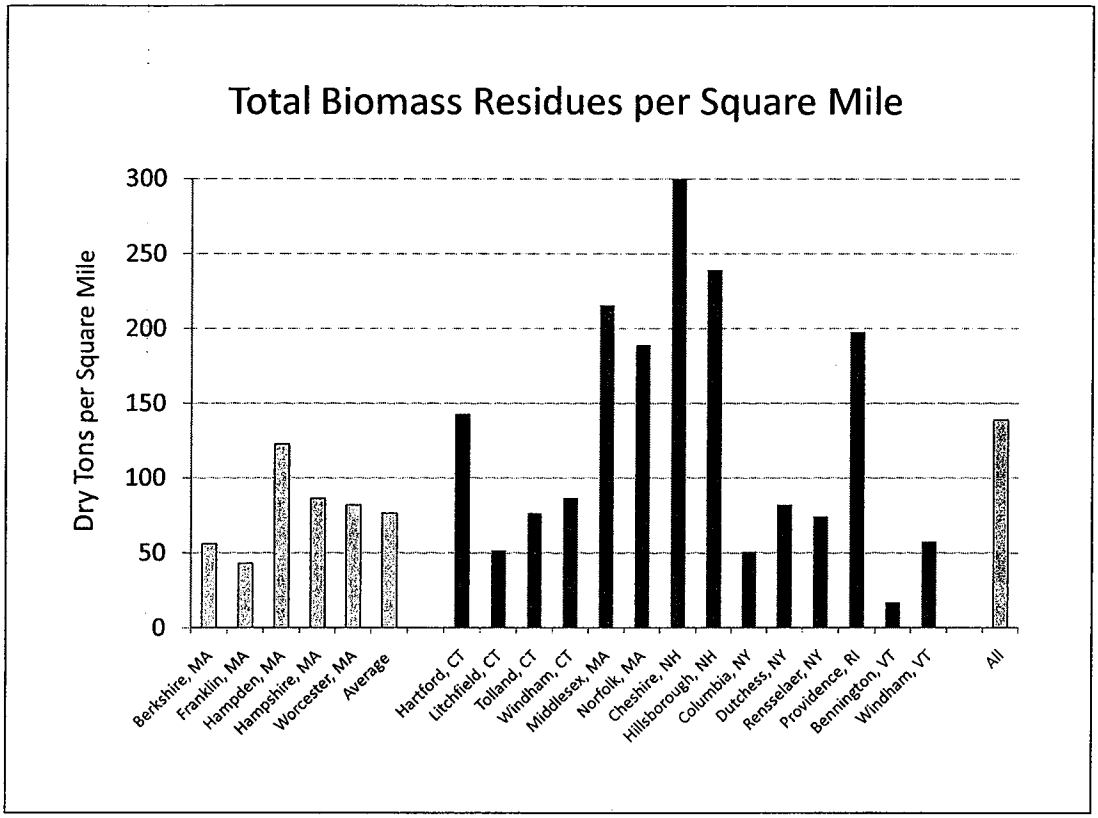


Figure 16 and Table 14 show the total available biomass from existing residues and land clearing activity for the core and buffer counties, in green tons (or equivalent).

Figure 17. Total Land Clearing and Biomass Residue (Potential), Green Tons

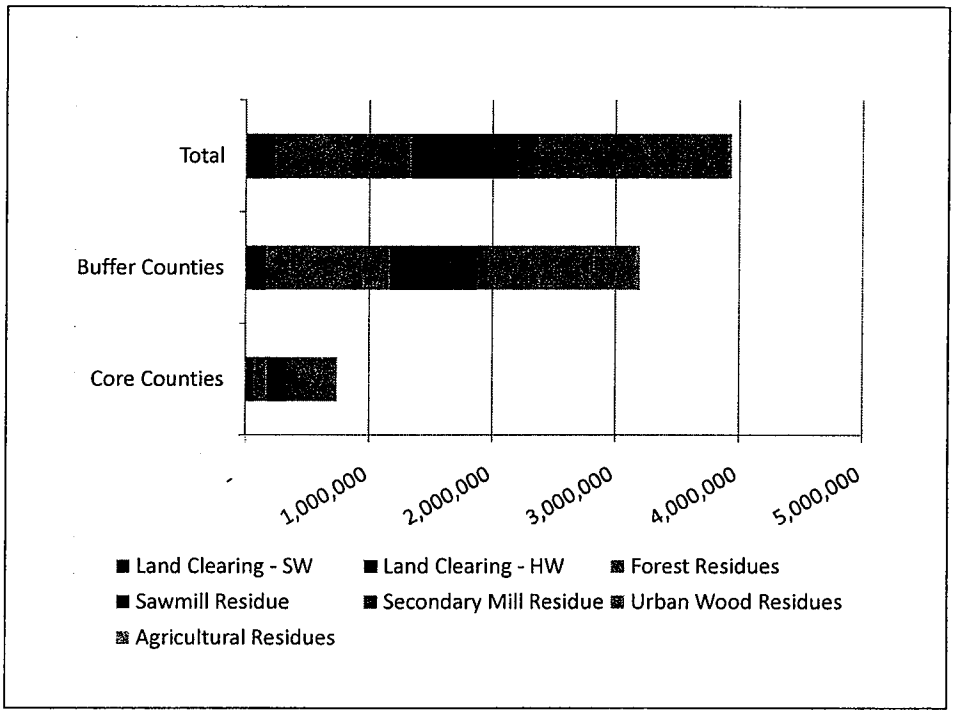


Table 14. Total Land Clearing and Biomass Residue (Potential), Green Tons

	Core Counties	Buffer Counties	Total
	green ton equivalent		
Land Clearing - Softwood	24,129	40,568	64,697
Land Clearing - Hardwood	53,061	111,328	164,389
Forest Residues	109,369	1,000,033	1,109,402
Sawmill Residue	153,276	705,906	859,182
Secondary Mill Residue	41,096	93,512	134,608
Urban Wood Residues	372,940	1,192,728	1,565,668
Agricultural Residues	-	37,062	37,062
Total Residue	*753,871*	*3,181,137*	*3,935,008*

Figure 17 and Table 15 show the same information as above, with the potentially available unutilized wood available from net forest growth. The large additions of biomass made possible by net forest growth shows the potential to substantially augment existing biomass residues. For this net forest growth to be utilized, new harvesting activity would need to occur and new harvesting equipment would need to be added to the region's logging infrastructure.

Figure 18. Total Land Clearing, Biomass Residues and Available Net Forest Growth (50%), Green Tons

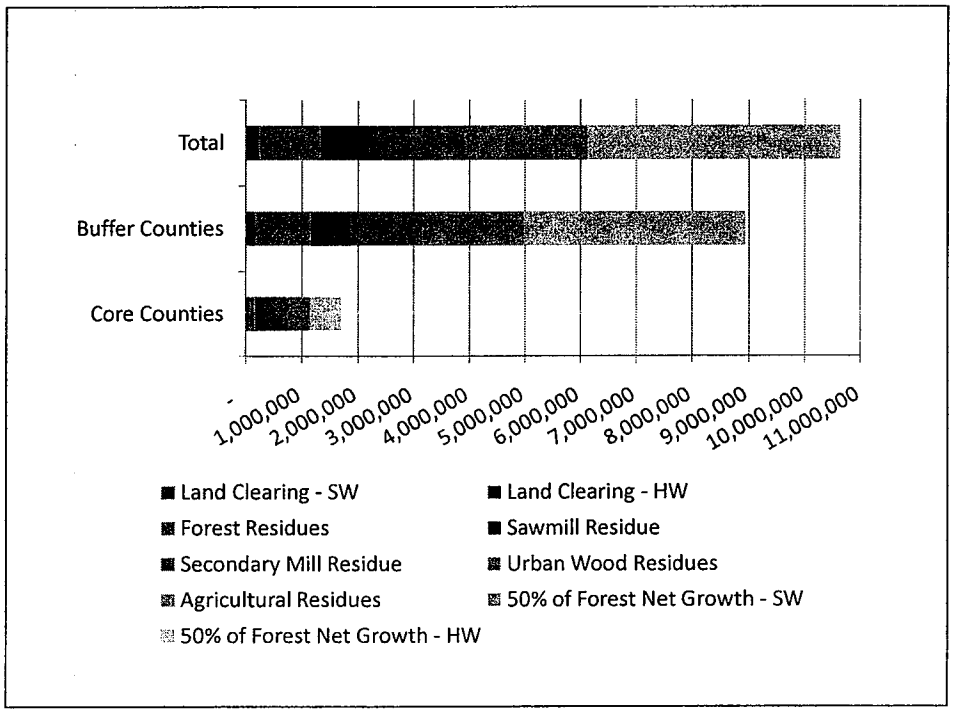


Table 15. Total Land Clearing, Biomass Residues and Available Net Forest Growth (50%), Green Tons

	Core Counties	Buffer Counties	Total
	green ton equivalent		
Land Clearing - Softwood	24,129	40,568	64,697
Land Clearing - Hardwood	53,061	111,328	164,389
Forest Residues	109,369	1,000,033	1,109,402
Sawmill Residue	151,276	705,906	857,182
Secondary Mill Residue	41,096	93,512	134,608
Urban Wood Residues	372,940	1,192,728	1,565,668
Agricultural Residues	-	37,062	37,062
50% of Forest Net Growth - Softwood	408,586	1,785,807	2,194,393
50% of Forest Net Growth - Hardwood	552,018	3,957,607	4,509,625
Total	*1,712,475*	*8,924,551*	*10,637,026*

Regional Markets for Low-Grade Wood

A number of markets exist or are proposed for low-grade wood, including but not limited to biomass fuel, for the Massachusetts and the areas that Massachusetts suppliers can economically access. Figure 18 shows the area of New England and New York that is within a four hour drive time of Pittsfield, Springfield or Worcester, Massachusetts highlighted in blue.

In this area there are thrity four active, idle or proposed facilities that use biomass, or low-grade wood that could be directed toward biomass energy production.

- Twenty operating facilities, with combined annual wood use of up to 11.1 million green tons;
- Five idle facilities, with combined annual wood use of a half million green tons;
- Nine publicly proposed facilities, in various stages of development, with total combined wood use of up to 4.7 million green tons.

These figures do not account for facilities that have been closed and dismantled (e.g., the pulp mill in Berlin, NH), as the infrastructure necessary for a re-start has been removed. Additionally, these figures do not account for the many project that are in the early stages of development, but have not made public announcements or taken obvious steps to begin development activities. These figures, and accompanying tables, show only markets big enough to exert their own market influence, and that represent a significant investment of fixed capital. Small facilities, such as seen at schools and hospitals, present excellent opportunities for biomass development, but these small units do not individually influence that overall market for and pricing of biomass fuel.

Figure 19 shows these facilities again, with each state color coded to match the tables that follow. These tables provide information on each facility, including:

- Facility name (commonly used name, may not be legal name)
- Location (town, state)
- Status (operating, idle, proposed, etc.)
- Owner (or operator)
- Product (electricity, paper, wood pellets, etc.)
- Size (MW capacity)
- Fuel type(s) used
- Annual wood use (green tons, estimated)
- Distance to Pittsfield, MA (road miles and time)
- Distance to Springfield, MA (road miles and time)
- Distance to Worcester, MA (road miles and time)

Figure 19. Major Regional Markets for Low-Grade Wood, 4 Hour Drive Time of Selected MA Cities

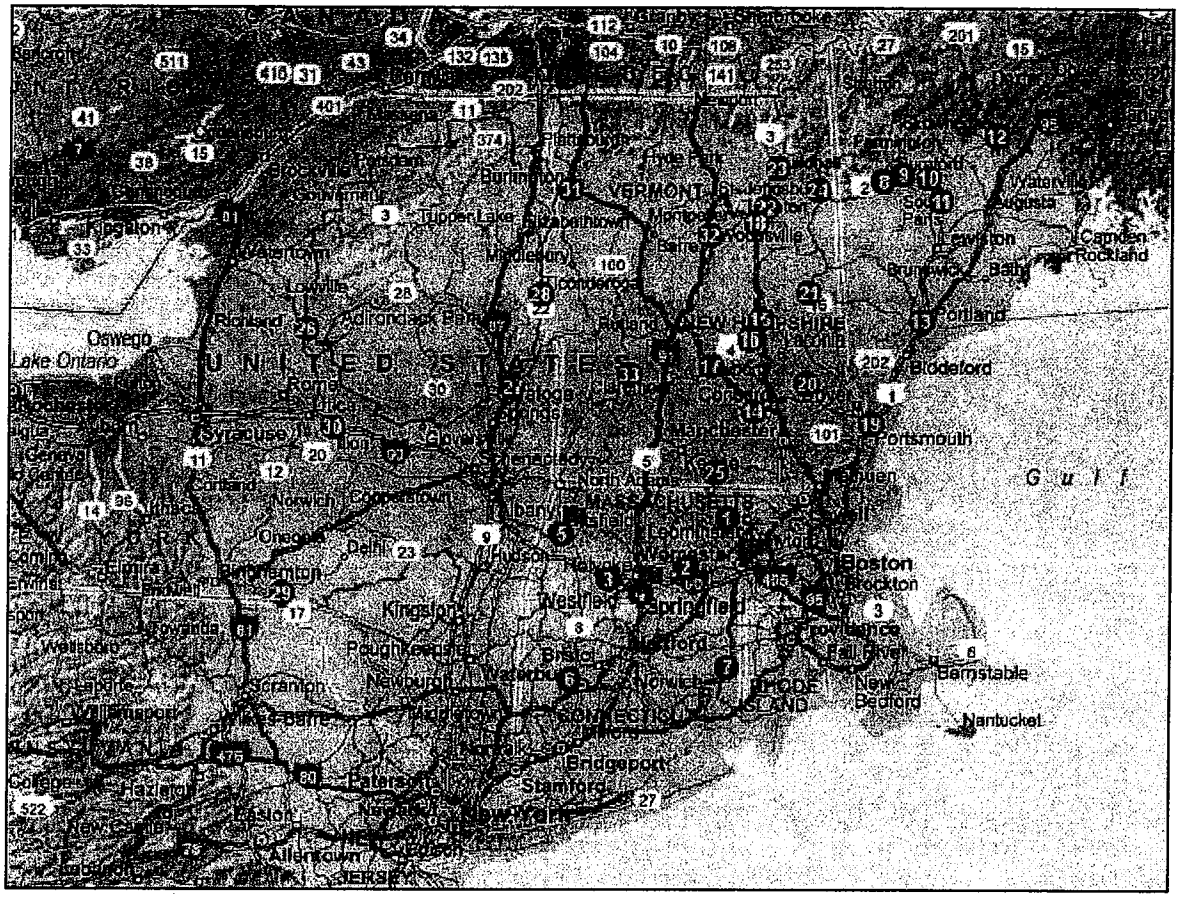


Figure 20. Regional Large Low-Grade Wood Consumers, Existing and Proposed

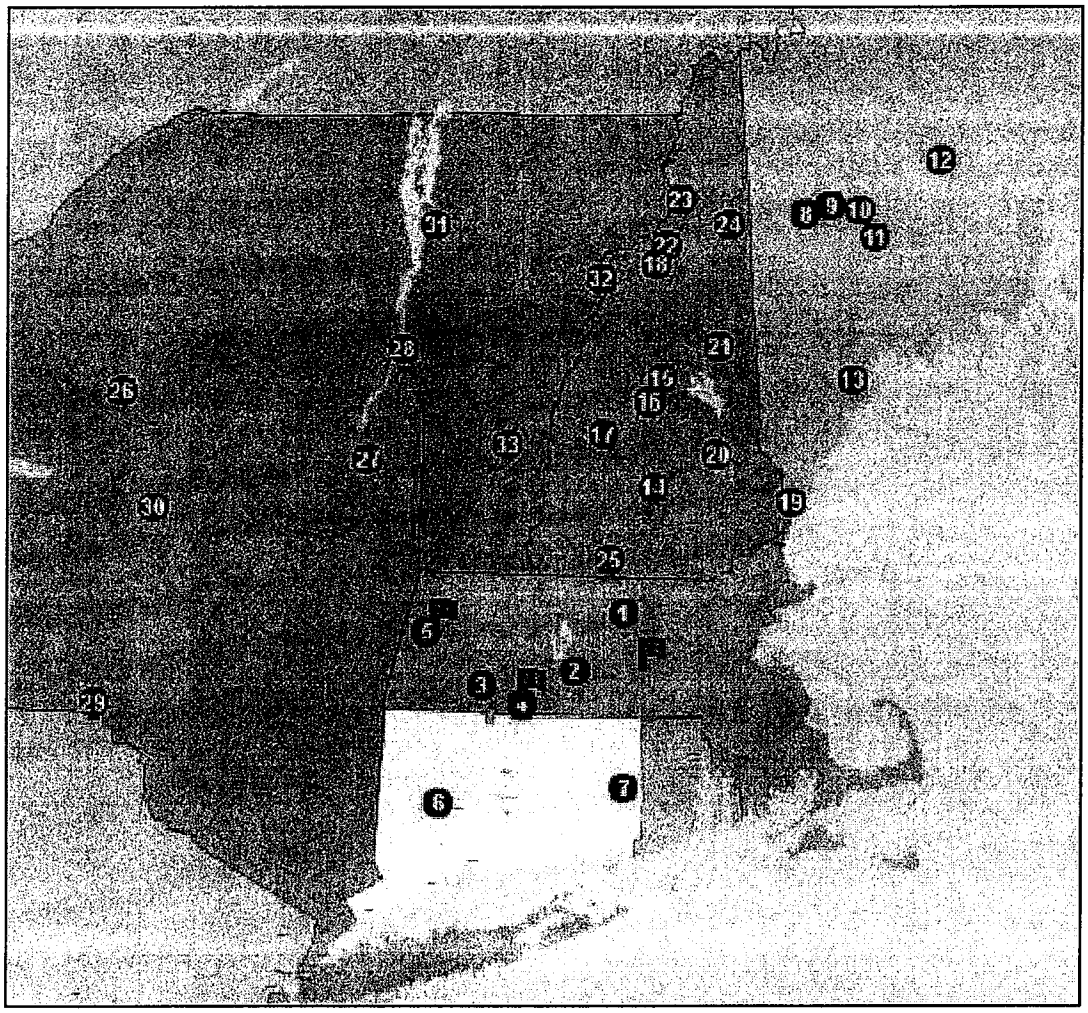


Table 16. Low-Grade Wood Market in Massachusetts

Facility 1	Pinetree – Fitchburg
Location	Westminster, MA
Status	Operating
Product	Electricity
Owner	Suez Energy North America
Size	17 MW (14 MW wood boiler, 3 MW landfill gas)
Fuel	Whole-tree chips, sawmill residue, ground pallets, paper cubes and landfill gas
Annual Wood Use (est.)	180,000 tons
Pittsfield – road miles	101 miles
Pittsfield – minutes	1 hour, 58 minutes
Springfield – road miles	63 miles
Springfield - minutes	1 hour, 19 minutes
Worcester – road miles	24 miles
Worcester - minutes	31 minutes

Facility 2	Ware Co-Gen
Location	Ware, MA
Status	Idle, approved for MA RECs
Product	Electricity
Owner	Ware Energy Company
Size	8.6 MW (2 units)
Fuel	Construction and demolition
Annual Wood Use (est.)	50,000 tons (estimate)
Pittsfield – road miles	74 miles
Pittsfield – minutes	1 hour, 23 minutes
Springfield – road miles	26.6 miles
Springfield - minutes	36 minutes
Worcester – road miles	28 miles
Worcester - minutes	41 minutes

Facility 3	Russell Biomass
Location	Russell, MA
Status	Proposed, in permitting
Product	Electricity
Owner	Russell Biomass LLC
Size	50 MW
Fuel	Whole tree chips, sawmill residue, pallets
Annual Wood Use (est.)	630,000 tons (estimate)
Pittsfield – road miles	39 miles
Pittsfield – minutes	49 minutes
Springfield – road miles	17 miles
Springfield - minutes	27 minutes
Worcester – road miles	67 miles
Worcester - minutes	1 hour, 10 minutes

Facility 4	Palmer Renewable Energy
Location	Springfield, MA
Status	Proposed
Product	Electricity
Owner	Palmer Renewable Energy
Size	30 MW
Fuel	Wood, derived from a variety of sources
Annual Wood Use (est.)	235,000 tons
Pittsfield – road miles	54 miles
Pittsfield – minutes	55 minutes
Springfield – road miles	0 miles
Springfield - minutes	0 minutes
Worcester – road miles	52 miles
Worcester - minutes	53 minutes

Facility 5	Berkshire Renewable Power
Location	Pittsfield, MA
Status	Proposed
Product	Electricity
Owner	Tamarack Energy
Size	30 – 50 MW
Fuel	Whole tree chips, sawmill residue, pallets
Annual Wood Use (est.)	Up to 600,000 tons
Pittsfield – road miles	0 miles
Pittsfield – minutes	0 minutes
Springfield – road miles	54 miles
Springfield - minutes	55 minutes
Worcester – road miles	100 miles
Worcester - minutes	1 hour, 42 minutes

Table 17. Low-Grade Wood Markets in Connecticut

Facility 6	Watertown Renewable Power
Location	Watertown, CT
Status	Proposed, in permitting
Product	Electricity
Owner	Tamarack Energy
Size	30 MW
Fuel	Whole tree chips, pallets, sawmill residue
Annual Wood Use (est.)	400,000 tons
Pittsfield – road miles	73 miles
Pittsfield – minutes	1 hour, 28 minutes
Springfield – road miles	58 miles
Springfield - minutes	1 hour, 7 minutes
Worcester – road miles	94 miles
Worcester - minutes	1 hour, 42 minutes

Facility 7	Plainfield Renewable Energy
Location	Plainfield, CT
Status	Proposed, in permitting
Product	Electricity
Owner	Decker Energy International and NuPower
Size	30 MW
Fuel	Whole tree chips, pallets, sawmill residue, woody fraction of construction and demolition debris
Annual Wood Use (est.)	400,000 tons
Pittsfield – road miles	130 miles
Pittsfield – minutes	2 hours, 8 minutes
Springfield – road miles	73 miles
Springfield - minutes	1 hour, 23 minutes
Worcester – road miles	44 miles
Worcester - minutes	46 minutes

Table 18. Low-Grade Wood Markets in Maine

Facility 8	New Page – pulp and paper mill
Location	Rumford, ME
Status	Operating
Product	paper
Owner	New Page
Annual Wood Use	Estimated at 1.1 million tons of pulpwood use annually
Status	Operating
Pittsfield – road miles	282 miles
Pittsfield – minutes	5 hours, 8 minutes
Springfield – road miles	275 miles
Springfield - minutes	4 hour, 47 minutes
Worcester – road miles	223 miles
Worcester - minutes	3 hours, 58 minutes

Facility 9	Catamount Co-Generation Company
Location	Rumford, ME
Status	Operating
Product	Electricity and thermal energy
Owner	Catamount Energy Corporation, http://www.catenergy.com/projects/rumford.html
Size	85 MW
Fuel	Coal, wood, oil, other opportunity fuels
Annual Wood Use (est.)	208,000 green tons in 2003
Pittsfield – road miles	282 miles
Pittsfield – minutes	5 hours, 8 minutes
Springfield – road miles	275 miles
Springfield - minutes	4 hour, 47 minutes
Worcester – road miles	223 miles
Worcester - minutes	3 hours, 58 minutes
Notes	Provides steam and power to the New Page pulp and paper mill

Facility 10	Androscoggin Mill
Location	Jay, ME
Status	Operating
Product	Paper
Owner	Verso Paper
Annual Wood Use (est.)	Pulpwood estimated at 1.4 million tons annually Biomass 245,000 green tons in 2003
Pittsfield – road miles	304 miles
Pittsfield – minutes	5 hours
Springfield – road miles	256 minutes
Springfield - minutes	4 hours, 13 minutes
Worcester – road miles	200 miles
Worcester - minutes	3 hours, 26 minutes

Facility 11	Boralex – Livermore Falls
Location	Livermore Falls, ME
Status	Operating
Product	Electricity
Owner	Boralex, www.boralex.com
Size	40 MW facility
Fuel	Whole tree chips, sawmill residue, construction & demolition debris (C&D may not continue)
Annual Wood Use (est.)	~350,000 tons per year, roughly half C&D debris
Pittsfield – road miles	302 miles
Pittsfield – minutes	4 hours, 49 minutes
Springfield – road miles	254 miles
Springfield - minutes	4 hours, 12 minutes
Worcester – road miles	197 miles
Worcester - minutes	3 hours, 23 minutes

Facility 12	SAPPI Fine Paper – Somerset Mill
Location	Skowhegan, ME
Status	Operating
Product	Paper
Owner	SAPPI Fine Paper NA
Annual Wood Use (est.)	Pulpwood estimated at 2.1 million tons annually Biomass 509,000 green tons in 2003
Pittsfield – road miles	335 miles
Pittsfield – minutes	5 hours, 22 minutes
Springfield – road miles	287 miles
Springfield - minutes	4 hours, 35 minutes
Worcester – road miles	232 miles
Worcester - minutes	3 hours, 49 minutes

Facility 13	SAPPI – Westbrook
Location	Westbrook, ME
Status	Operating
Product	Paper
Owner	SAPPI (South African Pulp & Paper Industries)
Size	50 MW
Fuel	Whole-tree chips, bark, pallets, construction & demolition, stump grindings
Annual Wood Use (est.)	400,000 to 500,000 tons per year
Pittsfield – road miles	243 miles
Pittsfield – minutes	3 hours, 56 minutes
Springfield – road miles	195 miles
Springfield - minutes	3 hours, 10 minutes
Worcester – road miles	140 miles
Worcester - minutes	2 hours, 23 minutes

Table 19. Low-Grade Wood Markets in New Hampshire

Facility 14	BioEnergy
Location	Hopkinton, NH
Status	Idle
Owner	Bio Energy Corporation (privately held)
Product	Electricity and thermal energy
Size	11 MW
Fuel	Traditionally whole-tree chips and pallets
Annual Wood Use (est.)	135,000 – 145,000 tons per year
Pittsfield – road miles	126 miles
Pittsfield – minutes	2 hours, 35 minutes
Springfield – road miles	115 miles
Springfield - minutes	2 hours, 9 minutes
Worcester – road miles	98 miles
Worcester - minutes	1 hour, 35 minutes

Facility 15	Bridgewater Power & Light
Location	Bridgewater, NH
Status	Operating
Product	Electricity
Owner	Privately held
Size	17 MW nameplate
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	225, 000 tons
Pittsfield – road miles	174 miles
Pittsfield – minutes	3 hours, 20 minutes
Springfield – road miles	182 miles
Springfield - minutes	2 hours, 53 minutes
Worcester – road miles	128 miles
Worcester - minutes	2 hours, 4 minutes

Facility 16	Alexandria Power
Location	Alexandria, NH
Status	Idle since 1994, intent to re-start announced
Product	Electricity
Owner	Indeck (sale pending – National Public Energy)
Size	16 MW
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	200,000 tons
Pittsfield – road miles	156 miles
Pittsfield – minutes	3 hours, 5 minutes
Springfield – road miles	150 miles
Springfield - minutes	2 hours, 43 minutes
Worcester – road miles	129 miles
Worcester - minutes	2 hours, 8 minutes

Facility 17	Hemphill Power & Light
Location	Springfield, NH
Status	Operating
Product	Electricity
Owner	Marubeni Sustainable Energy, Inc
Size	16 MW
Fuel	Whole-tree chips, wood chipped on-site and sawmill residue
Annual Wood Use (est.)	200,000 tons
Pittsfield – road miles	128 miles
Pittsfield – minutes	2 hours, 31 minutes
Springfield – road miles	122 miles
Springfield - minutes	2 hours, 8 minutes
Worcester – road miles	125 miles
Worcester - minutes	2 hours, 2 minutes

Facility 18	Pinetree – Bethlehem
Location	Bethlehem, NH
Status	Operating
Product	Electricity
Owner	Suez Energy North America
Size	17 MW
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	230,000 tons
Pittsfield – road miles	195 miles
Pittsfield – minutes	3 hours, 28 minutes
Springfield – road miles	189 miles
Springfield - minutes	3 hours, 6 minutes
Worcester – road miles	178 miles
Worcester - minutes	2 hours, 49 minutes

Facility 19	Northern Wood Power Station (Schiller Station)
Location	Portsmouth, NH
Status	Operating
Product	Electricity
Owner	Public Service of New Hampshire
Size	50 MW
Fuel	Whole-tree chips w/ some sawmill residue and pallets
Annual Wood Use (est.)	500,000 tons per year
Pittsfield – road miles	194 miles
Pittsfield – minutes	3 hours, 7 minutes
Springfield – road miles	145 miles
Springfield - minutes	2 hours, 20 minutes
Worcester – road miles	88 miles
Worcester - minutes	1 hour, 32 minutes

Facility 20	TIMCO
Location	Barnstead, NH
Status	Closed in 1994, idle
Product	Electricity and thermal energy
Owner	Privately held
Size	4.8 MW
Fuel	Sawmill residue, whole tree chips
Annual Wood Use (est.)	80,000
Pittsfield – road miles	154 miles
Pittsfield – minutes	3 hour, 12 minutes
Springfield – road miles	163 miles
Springfield - minutes	2 hours, 45 minutes
Worcester – road miles	110 miles
Worcester - minutes	1 hours, 57 minutes

Facility 21	Pinetree – Tamworth
Location	Tamworth, NH
Status	Operating
Product	Electricity
Owner	Suez Energy North America
Size	22 MW
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	300,000 tons
Pittsfield – road miles	257 miles
Pittsfield – minutes	4 hours, 20 minutes
Springfield – road miles	208 miles
Springfield - minutes	3 hours, 32 minutes
Worcester – road miles	151 miles
Worcester - minutes	2 hours, 44 minutes

Facility 22	DG Whitefield LLC (formerly Whitefield Power & Light)
Location	Whitefield, NH
Status	Operating
Product	Electricity
Owner	Marubeni Sustainable Energy, Inc
Size	13.8 MW
Fuel	Whole-tree chips, sawmill residue
Annual Wood Use (est.)	180,000 tons
Pittsfield – road miles	200 miles
Pittsfield – minutes	3 hours, 42 minutes
Springfield – road miles	195 miles
Springfield - minutes	3 hours, 20 minutes
Worcester – road miles	186 miles
Worcester - minutes	3 hours, 1 minute

Facility 23	North Country Renewable Energy
Location	Groveton, NH
Status	Proposed
Product	Electricity, thermal energy, liquid fuels
Owner	Tamarack Energy & XGenesys Development
Size	45 to 75 MW
Fuel	Whole tree chips, sawmill residue, pallets
Annual Wood Use (est.)	Up to 1.2 million tons
Pittsfield – road miles	222 miles
Pittsfield – minutes	3 hours, 57 minutes
Springfield – road miles	216 miles
Springfield - minutes	3 hours, 35 minutes
Worcester – road miles	203 miles
Worcester - minutes	3 hours, 24 minutes

Facility 24	Laidlaw EcoPower – Berlin
Location	Berlin, NH
Status	Proposed
Product	Electricity (potentially thermal energy)
Owner	Laidlaw Energy & EcoPower
Size	50 – 60 MW
Fuel	Whole tree chips, sawmill residue, pallets
Annual Wood Use (est.)	Up to 750,000 tons
Pittsfield – road miles	236 miles
Pittsfield – minutes	3 hours, 59 minutes
Springfield – road miles	242 miles
Springfield - minutes	4 hours, 21minutes
Worcester – road miles	204 miles
Worcester - minutes	3 hours, 44 minutes

Facility 25	New England Wood Pellet
Location	Jaffrey, NH
Status	Operating
Product	Wood pellets
Owner	New England Wood Pellet, www.pelletheat.com
Feedstock	Sawmill residue, sawdust, pulp quality chips
Annual Wood Use (est.)	120,000 tons (equivalent of roughly 160,000 green tons)
Pittsfield – road miles	99 miles
Pittsfield – minutes	2 hours, 10 minutes
Springfield – road miles	73 miles
Springfield - minutes	1 hour, 33minutes
Worcester – road miles	49 miles
Worcester - minutes	1 hour, 1 minute

Table 20. Low-Grade Wood Markets in New York

Facility 26	Lyonsdale Biomass
Location	Lyonsdale, NY
Status	Operating
Product	Electricity (thermal energy and liquid fuels potential)
Owner	Catalyst Renewables
Size	19 MW
Fuel	230,000 to 260,000 tons
Annual Wood Use (est.)	Operating
Pittsfield – road miles	172 miles
Pittsfield – minutes	3 hours, 8 minutes
Springfield – road miles	218 miles
Springfield - minutes	3 hours, 41 minutes
Worcester – road miles	263 miles
Worcester - minutes	4 hours, 24 minutes
Notes	This facility has been awarded up to $10.3 million from the State of New York to develop a wood-based cellulosic ethanol facility at this site. The project has a projected production of 130,000 gallons of ethanol. Assuming 80 gallons of ethanol for each dry ton of wood, this represents a very modest 3,250 green tons of new wood demand.

Facility 27	Finch Paper LLC
Location	Glens Falls, NY
Status	Operating
Product	Paper
Owner	Finch Paper Holdings LLC
Annual Wood Use (est.)	640,000 green tons of pulpwood 25,000 green tons of biomass
Pittsfield – road miles	88 miles
Pittsfield – minutes	1 hour, 41 minutes
Springfield – road miles	136 miles
Springfield - minutes	2 hours, 19 minutes
Worcester – road miles	180 miles
Worcester - minutes	2 hours, 58 minutes

Facility 28	Ticonderoga Mill
Location	Ticonderoga, NY
Status	Operating
Product	Paper
Owner	International Paper Company
Annual Wood Use (est.)	700,000 green tons of pulpwood (~2/3 hardwood) 80,000 green tons of biomass
Pittsfield – road miles	134 miles
Pittsfield – minutes	2 hours, 34 minutes
Springfield – road miles	181 miles
Springfield - minutes	3 hours, 11 minutes
Worcester – road miles	226 miles
Worcester - minutes	3 hours, 52 minutes

Facility 29	Norbord – Deposit
Location	Deposit, NY
Status	Operating
Product	Medium density fiberboard
Owner	Norbord, Inc.
Annual Wood Use (est.)	300,000 green tons (hardwood)
Pittsfield – road miles	205 miles
Pittsfield – minutes	3 hours, 31 minutes
Springfield – road miles	231 miles
Springfield - minutes	3 hours, 50 minutes
Worcester – road miles	267 minutes
Worcester - minutes	4 hours, 23 minutes

Facility 30	New England Wood Pellet
Location	Schuyler, NY
Status	Under Construction
Product	Wood pellets
Owner	New England Wood Pellet (Jaffrey, NH)
Annual Wood Use (est.)	~200,000 green tons (biomass)
Pittsfield – road miles	122 miles
Pittsfield – minutes	2 hours, 12 minutes
Springfield – road miles	169 miles
Springfield - minutes	2 hours, 47 minutes
Worcester – road miles	213 miles
Worcester - minutes	3 hours, 28 minutes

Table 21. Low-Grade Wood Markets in Vermont

Facility 31	McNeil Station
Location	Burlington, VT
Status	Operating
Product	Electricity
Owner	Burlington Electric Department (www.burlingtonelectric.com)
Size	50 MW
Fuel	Whole-tree chips, sawmill residue
Annual Wood Use (est.)	Up to 600,000 green tons (dispatched facility)
Pittsfield – road miles	155 miles
Pittsfield – minutes	3 hours, 6 minutes
Springfield – road miles	208 miles
Springfield - minutes	3 hours, 18 minutes
Worcester – road miles	239 miles
Worcester - minutes	3 hours, 47 minutes

Facility 32	Pinetree – Ryegate
Location	Ryegate, VT
Status	Operating
Product	Electricity
Owner	Suez Energy North America
Size	20 MW
Fuel	Whole-tree chips, wood chipped on-site and sawmill residue
Annual Wood Use (est.)	260,000 tons
Pittsfield – road miles	172 miles
Pittsfield – minutes	3 hours, 3 minutes
Springfield – road miles	166 miles
Springfield - minutes	2 hours, 41 minutes
Worcester – road miles	199 miles
Worcester - minutes	3 hours, 10 minutes

Facility 33	Access Ludlow Clean Energy Project, LLC
Location	Ludlow, VT
Status	Proposed
Product	Electricity
Owner	Access Energy
Size	25 MW
Fuel	Whole-tree chips, sawmill residue
Annual Wood Use (est.)	315,000 tons
Pittsfield – road miles	86 miles
Pittsfield – minutes	1 hour, 41 minutes
Springfield – road miles	106 miles
Springfield - minutes	2 hours
Worcester – road miles	108 miles
Worcester - minutes	2 hours, 33 minutes

Facility 34	Dirigo Paper Company
Location	Gilman, VT
Status	Idle
Product	Paper
Owner	Dilton Hydro LLC
Fuel	Whole-tree chips, sawmill residue
Annual Wood Use (est.)	35,000 tons
Pittsfield – road miles	209 miles
Pittsfield – minutes	3 hour, 42 minutes
Springfield – road miles	203 miles
Springfield - minutes	3 hours, 20 minutes
Worcester – road miles	188 miles
Worcester - minutes	3 hours, 6 minutes

Endnotes

[i] Data developed using latest publicly available USDA Forest Service Forest Inventory & Analysis information – Connecticut 1998, Massachusetts 1998, New Hampshire 1997, New York 1993, Rhode Island 1998, and Vermont 1997.
[ii] This is a typical number; actual efficiency will vary by technology, fuel characteristics, and other factors.
[iii] Data developed using latest available complete USDA Forest Service Forest Inventory & Analysis. All FIA data is provided in cubic feet; converted to green tons assuming 85 feet of solid wood in a cord, a cord of hardwood weighing 2.6 tons, and a cord of softwood weighing 2.3 tons.
[iv] North East State Foresters Association. *Carbon Sequestration and Its Impacts on Forest Management in the Northeast.* December 19, 2002. www.nefainfo.org
[v] Data developed using latest available complete USDA Forest Service Forest Inventory & Analysis. All FIA data is provided in cubic feet; converted to green tons assuming 85 feet of solid wood in a cord, a cord of hardwood weighing 2.6 tons, and a cord of softwood weighing 2.3 tons.
[vi] The issue of forest sustainability standards for biomass fuel is beyond the scope of this report, and is a complex and controversial subject matter. However, at least one state, Minnesota, has developed draft biomass harvesting standards. *Draft Biomass Harvesting on Forest Management Sites in Minnesota.* Prepared by the Minnesota Forest Resources Council Biomass Harvesting Guideline Development Committee. May 1, 2007. www.forestrycenter.org
[vii] This figure includes a remarkably high volume of logging residue in Cheshire County, NH. This information could be incorrect or could be the result of unique local conditions. INRS has confirmed the data with the USDA Forest Service and the US Department of Energy / National Renewable Laboratory, and both parties indicate that the baseline data as reported is correctly listed.
[viii] The database used for this table shows a remarkably high volume of logging residue available in Cheshire County, NH. While this county does have significant forest resources, a high degree of logging activity, and is distant to major low-grade wood markets, INRS suspects that the figure supplied for Cheshire County, NH may be high. It is reported with this caution.
[ix] Based upon data from the USDA Forest Service Timber Product Output analysis, the US Department of Energy / National Renewable Energy Laboratory, and the US Census Bureau.
[x] Wakefield, Emily. "PyNe Workshop Report." *ThermalNet.* Issue 04. June 2007.
[xi] Based upon data from the USDA Forest Service Timber Product Output analysis, the US Department of Energy / National Renewable Energy Laboratory, and the US Census Bureau.
[xii] Damery, David, Curt Bellemer and Gordon Boyce. *Massachusetts Directory of Sawmills & Dry Kilns.* 2006.
[xiii] Innovative Natural Resource Solutions LLC. *Feasibility Analysis of Medium Density Fiberboard Manufacturing in New Hampshire.* Prepared for the NH Department of Resources & Economic Development. July 2001.
[xiv] Assumes 1,350 green tons of mill chips per MBF of lumber production, based on mill size and species mix in the area.
[xv] Based upon data from the USDA Forest Service Timber Product Output analysis, the US Department of Energy / National Renewable Energy Laboratory, and the US Census Bureau.
[xvi] Based upon data from the US Environmental Protection Agency, the US Department of Energy / National Renewable Energy Laboratory, and the US Census Bureau.
[xvii] Based upon data from the US Department of Agriculture, the US Department of Energy / National Renewable Energy Laboratory, and the US Census Bureau.
[xviii] Based upon data from the US Census Bureau and the USDA Forest Service.
[xix] Based upon data from the USDA Forest Service Timber Product Output analysis, the US Department of Agriculture, the US Environmental Protection Agency, the US Department of Energy / National Renewable Energy Laboratory, and the US Census Bureau.
[xx] Because much "urban wood" is low in moisture content (e.g., pallets, which have been kiln dried prior to use), information on this resource is listed in dry tons. For purposes of comparison, dry tons can be converted to green tons by multiplying by 1.8.

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