# Sutton, Vermont

# Burke Lumber Site Re-development

# Wood Supply Assessment

# and

# Wood Pellet Manufacturing Facility Feasibility Analysis/Business Plan

June, 2009

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# Executive Summary

In 2008, the Town of Sutton, Vermont, with the assistance of the Northeastern Vermont Development Association, designed a project to determine the feasibility of re-developing the former Burke Lumber mill site in Sutton into a new wood using industry. The Town hired Innovative Natural Resource Solutions LLC to undertake the work.

The project is funded through a Vermont Community Development Program Grant Agreement between the State of Vermont, Agency of Commerce and Community Development and the Town of Sutton #07110-PG-I-2007-Sutton-00016.

The project consisted of three major components. This report contains the three phases of the project - a wood supply assessment, wood pellet plant feasibility study and business plan.

The purpose of this report is to provide the basis for an entity to successfully obtain financing to construct and operate a wood pellet manufacturing facility in Sutton, Vermont at the site of the former Burke Lumber mill.

The results of this feasibility study and business plan for the wood pellet mill are positive:

- The site is adequate for the proposed facility;
- Wood raw material is available in adequate quantities and at an acceptable price;
- The financial returns show an acceptable Return on Investment as outlined in the *pro forma* financial analysis for the project.

**Contents**



**Tables & Figures**



**About Innovative Natural Resource Solutions LLC**

INRS LLC is a multi-service natural resource consulting company with clients in the non-profit, private and government sectors from throughout North America. Founded in 1994, INRS specializes in assisting clients in resolving today's complex natural resource management and business challenges. The company principals bring over 45 years of extensive experience, energy and creativity to this important work.

## 1. Statement of Purpose

The purpose of this wood supply assessment, feasibility study and business plan is to provide the basis for an entity to successfully obtain financing to construct and operate a wood pellet manufacturing facility in Sutton, Vermont at the site of the former Burke Lumber mill.

## 2. Introduction

In 2008, the Town of Sutton, Vermont, with the assistance of the Northeastern Vermont Development Association, designed a project to determine the feasibility of re-developing the former Burke Lumber mill site in Sutton into a new wood using industry. The mill closed over a decade ago and although the site has been used recently for a log yard, the hope is that the site will be more fully utilized by a wood using industry. The Town issued a Request for Proposals to conduct the study and, with the assistance of a Steering Committee (see Appendix), hired Innovative Natural Resource Solutions LLC to undertake the work.

The project is funded through a Vermont Community Development Program Grant Agreement between the State of Vermont, Agency of Commerce and Community Development and the Town of Sutton #07110-PG-I-2007-Sutton-00016.

The project consisted of three major components. The outline for the three phases of the project is as follows:

I. **Fuel Wood Market Analysis**
   - Supply Assessment
   - Market Demand
   - Competition

II. **Business Organization & Setup**
   - Facility Size
   - Operations & Costs

III. **Site Feasibility Analysis**
   - Site Review

The first phase determined the amount and kinds of wood potentially available for use at the Sutton site given a series of assumptions. Following the completion of the first phase, the Town of Sutton, assisted by the Steering Committee and the recommendation of the consultant, determined that the likeliest alternative future use of the site is to develop a new wood pellet manufacturing facility. Phases II and III, designed to complete a business feasibility analysis and plan for the wood pellet mill, were then completed. This report includes the reports from all three phases of the effort.

# Phase I – Wood Supply Assessment

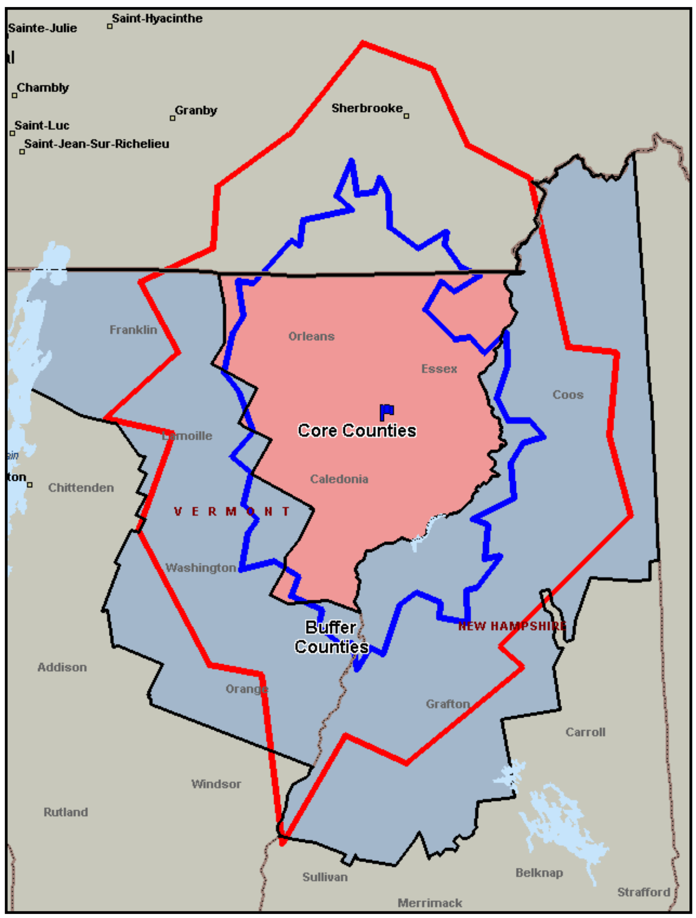
### 3. Net Forest Growth

In order to determine potentially available wood for a low-grade facility for the Sutton site, INRS identified core and buffer areas based on drive times. Drive times of 60 and 90 minutes were used to identify core and buffer counties, shown below.

- *Core Counties* – Caledonia, Essex, Orleans
- *Buffer Counties* – Franklin, Lamoille, Orange, Washington, Coos (NH), Grafton (NH)

Areas in Quebec fall within the drive times noted. However, similar data sets are not accessible for Canada, and as such the information presented should be viewed as incomplete and conservative.

**Figure 1.** Core and Buffer Counties, with 60 and 90 Minute Drive Times




Net forest growth refers to the annual level of forest growth on timberland (forestland capable of growing wood and where timber can legally be harvested) above the annual harvest level. In other words, net forest growth answers the question – "With all historic forest products markets in place[i], and all current land use trends in place, how much wood is growing above the current harvest levels?" The net growth refers only to the "roundwood" portion of a tree – the stem that can be used for a variety of forest products, including as a biomass feedstock. An increase in harvest levels would also cause an increase in residue availability (tops and branches), at roughly 0.3 green tons of forest residue for each additional ton of roundwood harvested[ii].

Using the USDA Forest Service's Forest Inventory and Analysis[iii] tool, a national resource on standing timber volumes, trends in timber growth and harvest, INRS determined the net growth on timberland on a per-county basis.[iv] This should be considered a theoretical maximum[v] – it is not generally ecologically desirable to utilize all growth, and even if acceptable, there are other limiting factors across the landscape, including:

- Landowner attitudes toward timber harvesting;
- Terrain (including proximity to steep slopes, 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).

Within the core counties, there are roughly 1.1 million acres of accessible forestland, representing 84 percent of the land base. When buffer counties are included, there is a total of 4.4 million acres of accessible forestland, representing 85 percent of all land.

**Table 1.** Land and Forest Area for Core and Buffer Counties[vi]

| State | County | Total Land | Accessible Forest | Non-Forest | % Forested |
|---|---|---|---|---|---|
| | | | Acres | | |
| Vermont | Caledonia | 416,918 | 345,722 | 71,196 | 83% |
| Vermont | Essex | 426,043 | 405,720 | 20,323 | 95% |
| Vermont | Orleans | 445,812 | 332,067 | 113,746 | 74% |
| *Core Counties* | | *1,288,773* | *1,083,508* | *205,265* | *84%* |
| New Hampshire | Coos | 1,153,013 | 1,108,950 | 44,063 | 96% |
| New Hampshire | Grafton | 1,095,661 | 960,642 | 135,019 | 88% |
| Vermont | Franklin | 408,860 | 277,862 | 130,998 | 68% |
| Vermont | Lamoille | 295,135 | 242,242 | 52,892 | 82% |
| Vermont | Orange | 441,367 | 343,116 | 98,252 | 78% |
| Vermont | Washington | 440,107 | 348,530 | 91,577 | 79% |
| *Buffer* | | *3,834,143* | *3,281,341* | *552,802* | *86%* |
| *Core and Buffer* | | *5,122,915* | *4,364,849* | *758,066* | *85%* |

Within the core counties, growth exceeds removal by 357,000 green tons per year, with annual net growth of 0.28 green tons per acre[vii]. When buffer counties are included, annual net growth is nearly 1.34 million green tons, or 0.26 green tons per acre. Net growth, as calculated by the USDA Forest Service Forest Inventory and Analysis includes only merchantable roundwood; inclusion of tops and branches would add roughly 0.29 green tons of forest residue for each green ton of roundwood.

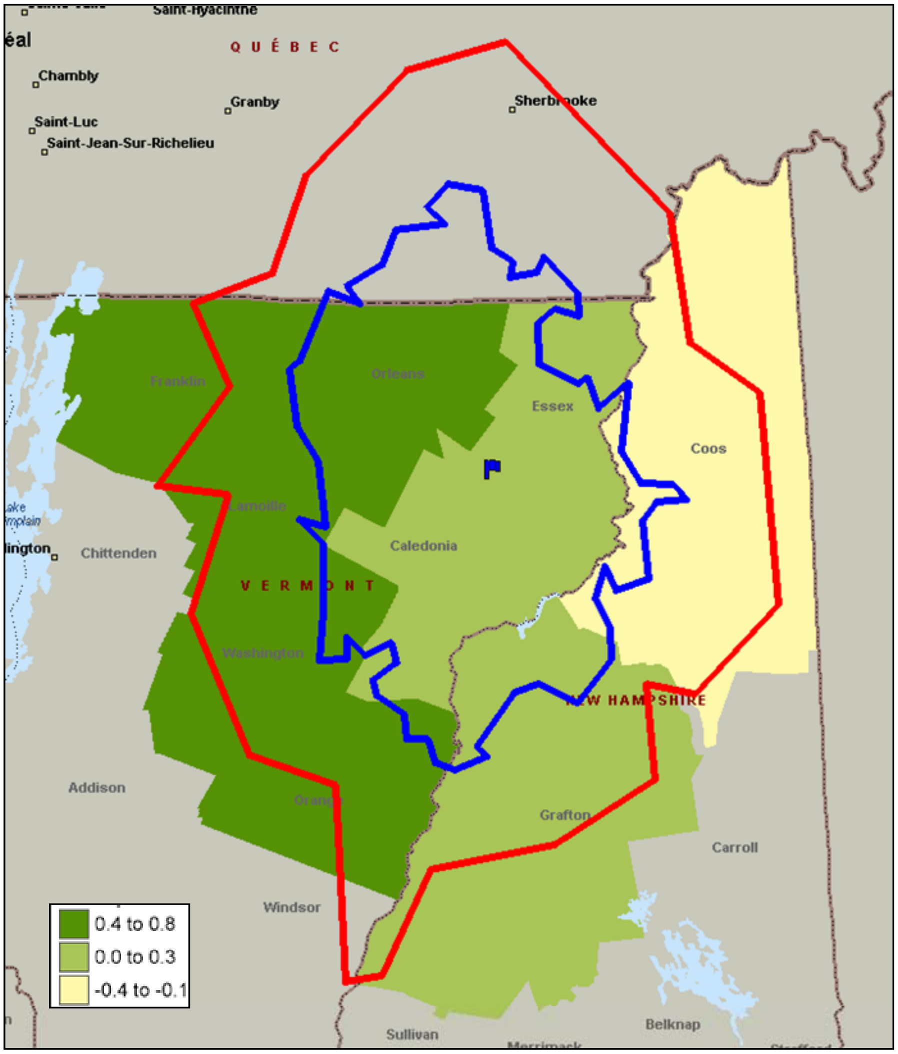
**Table 2.** Net Forest Growth, Core and Buffer Counties

| State | County | Growth | Removals | Net Growth | Net Growth (g tons / acre) |
|---|---|---|---|---|---|
| | | Green tons | | | |
| Vermont | Caledonia | 411,221 | 367,653 | 43,568 | 0.10 |
| Vermont | Essex | 469,523 | 397,353 | 72,170 | 0.17 |
| Vermont | Orleans | 440,656 | 199,101 | 241,555 | 0.54 |
| *Core* | | *1,321,400* | *964,107* | *357,293* | *0.28* |
| New Hampshire | Coos | 717,865 | 1,071,076 | -353,211 | (0.31) |
| New Hampshire | Grafton | 1,010,787 | 649,310 | 361,478 | 0.33 |
| Vermont | Franklin | 461,946 | 186,680 | 275,266 | 0.67 |
| Vermont | Lamoille | 290,150 | 61,832 | 228,318 | 0.77 |
| Vermont | Orange | 381,945 | 167,930 | 214,016 | 0.48 |
| Vermont | Washington | 441,643 | 184,981 | 256,662 | 0.58 |
| *Buffer* | | *3,304,336* | *2,321,809* | *982,527* | *0.26* |
| *Core and Buffer* | | *4,625,736* | *3,285,916* | *1,339,820* | *0.26* |

It is worth highlighting that Coos County in New Hampshire, as one of the buffer counties and a likely source of some wood for a facility sited at the Sutton property, shows a net loss of wood. This means that, at least when these data were collected, more wood was being harvested annually than the county's forests were growing in a year. While this may have been the case when the FIA data was collected, two pulp mills located in the county have since closed. Newer information suggests that the current harvest levels are more in line with gross growth. Other studies completed for the northern part of New Hampshire, most notably one completed for Clean Power Development in 2008 by INRS LLC and a second more recently released in late 2008 by LandVest, completed for the North Country Council, support this belief.

When viewed geographically, it is clear that the opportunities for capture of unutilized forest growth are in the region immediately surrounding Sutton and to the west. This makes sense, as this leans away from existing and historic pulpwood markets in Maine and New Hampshire.

**Figure 2.** Net Growth Density (Green Tons/Acre), by County



## 4. Biomass Availability

Based upon FIA removals and net growth information above, INRS calculated the *theoretically available* volume of biomass fuel derived from tops and branches. This assumes that for each green ton of roundwood harvested (sawlog or pulpwood), another 0.29 green tons is available from tops, branches, and off-spec roundwood. Given limitations on the volume of tops and branches that can be captured from a harvest in a manner that is both economically and ecologically sound, INRS has discounted this volume by fifty percent[viii]. Assuming capture of half of the tops and branches from existing harvest and net growth, the core counties have roughly 190,000 (enough fuel for a 14 MW wood-fired facility) green tons of biomass available, and the core and buffer counties have 615,000 (enough fuel for a 48 MW facility) for a green tons available.

**Table 3.** Potentially additional biomass available for a new wood market in Sutton (green tons)

| State | County | Removals | Net Growth | Total | Less 50% |
|---|---|---|---|---|---|
| **Vermont** | **Caledonia** | 106,619 | 12,635 | 119,254 | 59,627 |
| **Vermont** | **Essex** | 115,232 | 20,929 | 136,162 | 68,081 |
| **Vermont** | **Orleans** | 57,739 | 70,051 | 127,790 | 63,895 |
| ***Core*** | | *279,591* | *103,615* | *383,206* | *191,603* |
| **New Hampshire** | **Coos** | 310,612 | (102,431) | 208,181 | 104,090 |
| **New Hampshire** | **Grafton** | 188,300 | 104,829 | 293,129 | 146,564 |
| **Vermont** | **Franklin** | 54,137 | 79,827 | 133,964 | 66,982 |
| **Vermont** | **Lamoille** | 17,931 | 66,212 | 84,144 | 42,072 |
| **Vermont** | **Orange** | 48,700 | 62,065 | 110,764 | 55,382 |
| **Vermont** | **Washington** | 53,644 | 74,432 | 128,076 | 64,038 |
| ***Buffer*** | | *673,325* | *202,709* | *876,033* | *438,017* |
| ***Core and Buffer*** | | *952,916* | *277,141* | *1,230,056* | *615,028* |

These figures should be viewed as theoretical maximums that do not account for existing markets or contain any analysis of the logging infrastructure needed to accumulate, transport and harvest woody biomass to a facility. For instance, the large pulp mills in northern New Hampshire, which are now closed, were operating at the time the FIA data was collected. This suggests that harvest levels are currently lower, and available biomass higher, than the FIA data indicates.

4.1 Availability and Long-Term Contracts for Wood

Availability of wood, assuming adequate stocking and growth in the forest that assures long-term sustainability of the resource, is dependent on myriad factors. These include:

- Landowner attitudes and interest in harvesting;
- Regulatory constraints;
- Physical limits of the forests for harvesting;
- Adequate logging infrastructure;
- Weather and season;
- Other factors.

To date, wood in the northeast region of the United States has been purchased largely on the spot market or with very short term contracts. While true contracts exist, locking in volumes and prices for delivered wood to wood-using facilities, they rarely exceed 1 year. Even those contracts that exist for a year tend to be full of flexibility, usually consisting of not-to-exceed volumes that a particular wood producer/logger can deliver to the mill during the contract period. Some contracts have included prices for delivered wood or price ranges that depend on the current price set by the wood-using facility. Shorter term contracts, say for a particular logging job that may last a month or so, may have firm prices for that short period. True long-term contracts do not exist primarily because of the uncertainties present for both seller and buyer of wood products originating in the forest.

Many natural resource commodities (such a crude oil for instance), have long had futures markets that allow for long-term purchases and contracts between buyers and sellers of that resource. The forest products industry has not yet developed a futures market for its commodity products such as logs, chips and pulpwood. A futures market for wood would allow for true contracts between suppliers of wood products and users/markets to develop longer term agreements that would provide assurances of price and volumes for all parties involved.

Recent work from a New York project, "Establishing Long-Term Supply Agreements for Wood Energy Facilities" [ix] (the report is still in draft form and under review), provides more insights into this phenomenon and points toward reasons why long-term wood supply contracts for a facility at the Sutton, Vermont site are unlikely. The report cites the following reasons why long-term supply contracts do not currently exist in the wood products industry:

- A disconnected supply chain, where no one party (e.g., a logger) controls other parts of the supply chain (e.g., land) sufficiently to guarantee future supply;
- A generalized belief on the part of potential suppliers that biomass markets will improve over time, and that entering into longer-term contracts will prove to be a disadvantage;
- Inability of suppliers to accurately forecast and hedge against changes in their cost structure, particularly volatility in diesel prices, a major component of biomass fuel prices;
- For suppliers that may consider entering into long-term supply arrangements, they are often small (by energy company financing standards), and not viewed as sufficiently "credit worthy" to enter into long-term contracts.

The New York study, which included exhaustive interviews with parties in the wood supply chain and a workshop with key supply chain representatives designed to seek a method for long-term wood supply contracting, reached the following conclusions:

- No single model for long-term agreements was thought universally feasible by suppliers and wood market representatives;
- The one alternative highly sought by markets/wood-using facilities/developers, that of fixed price contracts over a term, was rejected by all wood suppliers involved;
- Opportunities may exist to structure long-term agreements based on wood market financing of suppliers or some other more encompassing approach.

The result is that long-term wood supply agreements, while highly desirable for some parties, are not feasible in the near future. Wood suppliers will not enter into long-term contracts, for all the reasons described above. This challenges those wishing to develop wood-using facilities, as lenders want business plans that include assurances for raw material supply.

### 4.2 Returns to Landowners, Loggers and Truckers

The discussion above on long-term wood supply agreements leads logically to a discussion about monetary returns to the key players in the wood supply side of the wood-based industries: landowners, loggers and truckers. Returns to these players are dependent on a number of factors including:

- Delivered price for the raw material at the mill (which is in turn dependent on the end product price paid to that manufacturer and the costs of producing that product);
- Trucking costs (which are dependent on a host of costs such a capital costs, labor, diesel fuel and distance to market);
- Logging costs (which are dependent on a similar group of costs plus the cost of the stumpage or purchased wood);
- Quality and accessibility of the wood to be harvested.

When full market knowledge is available, forest landowner returns from the sale of products from their forests are affected by all of these factors. Further, returns to landowners vary widely for various products since delivered price to the mill, a key factor that translates to payments to forest landowners, varies widely for various products. The range of products, shown in order of delivered price value, is:

- Sawlogs and veneer logs;
- Pulpwood;
- Firewood;
- Chips for Paper
- Whole Tree Chips (for energy).

The value to the landowner of, for example, a ton equivalent of whole tree chips, on the lower end of the value chain, can easily be only 2% of sawlog value on the upper end[x] given today's market prices. While this could and will likely change over time, landowners will simply not be in a position to receive substantial returns from wood going to the lower-end energy markets unless the price structure changes at the end-user market. It should be noted that prices for the lower end wood material have changed – stumpage (standing timber) prices for whole tree chip material have more than doubled in the last five years. It was not uncommon for landowners in 2003 to receive $.50 per ton of standing whole tree chip wood.

## 5. Use Value Assessment and Large Landowners within Sutton Procurement Region

The use of the data set described in this section was primarily for comparison and truthing purposes. Normally, the USDA Forest Service data is the sole raw data used for an analysis of this sort. Because an additional dataset was available, INRS chose to use it to verify the data, analyses and conclusions of the USDA data.

5.1 <u>A second and third dataset</u>. - In addition to the sources of timber data described in the previous section from the USDA Forest Service Forest Inventory, a second data set was developed.

A database of the Vermont Use Value Assessment data for two counties within the Sutton procurement region, Essex and Caledonia Counties, has been developed through the work of the State of Vermont and others. The intent is to eventually have this data, with a GIS dataset to go along with it, for all the counties in Vermont. This dataset was provided by Matt Langlais, Caledonia and Essex County Forester. Additionally, INRS developed similar data for the large "commercial" forest ownerships in the Sutton procurement area within Vermont and New Hampshire.

5.2. <u>The data</u>. The Use Value Assessment (UVA) dataset, contained in Microsoft Access, Excel and ArcMap files, contains:

~ county and town
~ owner name, address, city, state and zip code
~ consulting forester
~ parcel acreage as reported by owner
~ year the parcel entered the program [not complete], year of the most recent management plan, and last year the parcel was inspected
~ hardwood board foot volume harvested in that year (2005, 06 and 07)
~ softwood board foot volume harvested in that year
~ hardwood cords harvested in that year
~ softwood cords harvested in that year
~ tons of chips harvested in that year

The data in this database covers only UVA lands harvested on in any given year. The acreage involved averages 91,000 acres for the three-year period from 2005-2007. The range of acreage involved is 58,000 to 114,000 acres. It must be clarified that this acreage does <u>not</u> represent the number acres harvested but the acreage owned under UVA by the landowner who conducted a harvest.

It should be noted that while an impressive dataset, not all UVA landowners file their activity reports on time (or at all). It is likely that under-reporting occurs relative to harvests and harvest levels.

The ArcMap shapefile contains spatially referenced data for all enrolled land at the forest stand level, not the parcel level. Data contained in the shapefile includes:
~ owner name
~ area of each stand (as calculated by ArcMap) in acres and hectares
~ area of each stand in acres (as reported by landowner)
~ timber type, quadratic mean stand diameter, total basal area, basal area of acceptable growing stock
~ scheduled management activities and scheduled dates for those activities (not updated as each activity occurs, but every time a new management plan is submitted).

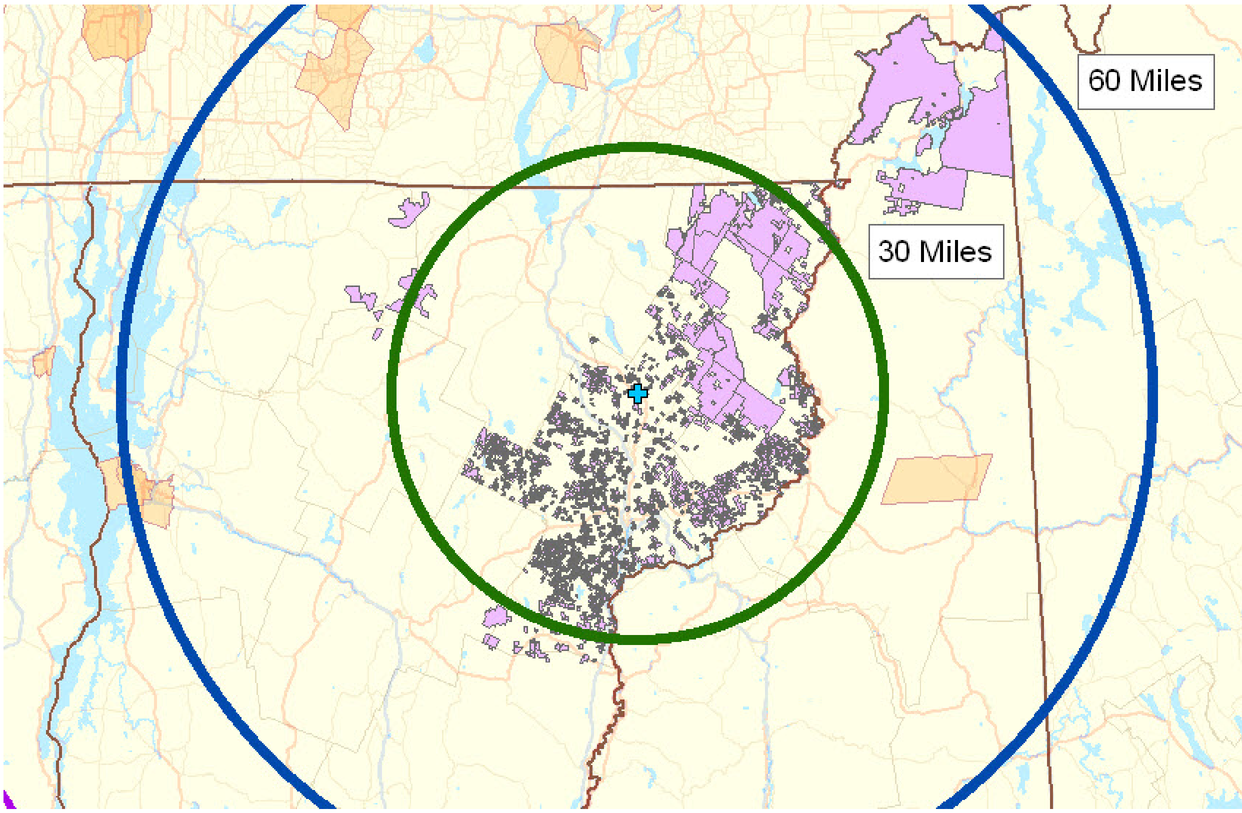
For the purposes of this report, only summarized data is being shown in order not to release sensitive information about any single landowner under UVA.

The large landowner dataset contains 313,000 additional acres of land (over and above the UVA dataset). This information in this dataset is confidential and is summarized in total here at the request of the landowners. Ownership sizes in this dataset range from just over 8,000 acres to nearly 150,000 acres and include land in both Vermont and New Hampshire. All the ownerships studied have inoperable acres from a timber harvesting perspective. This is due to physical and legal constraints, primarily. Since the land in the datasets are required to be harvested by law (UVA) or by financial needs, landowner attitudes on these acres have been discounted. Generally, it is assumed that 80-85% of the lands in question are operable for harvesting purposes (15-20% unavailable). We can expect a slightly higher percentage to be unavailable for harvesting for forestlands in general in the Sutton procurement region.

5.3. Map of UVA and Large Landowner dataset

Using an ArcMap shapefile from the UVA database along with other shapefiles obtained from other sources, the following map was developed to show the geographic relationship between the lands and their data and the Sutton site. The Sutton location is shown as the blue + in the center of the map. The circles represent distance from the Sutton site. Drive-time maps are developed and shown elsewhere in this report. The map demonstrates that a large portion of the lands in the UVA and Large Landowner datasets are within 30 miles of the Sutton location. Other lands are within the 60 mile radius.

**Figure 3.** Location of Vermont Use Value Assessment lands in Caledonia and Essex Counties, Vermont and other large forest ownerships within the region.




*Note: A number of the large land ownerships within the third dataset developed for this project are not outlined on the map for proprietary reasons.*

5.4. <u>Results of the data analysis</u>

Data from the UVA data set and large landowner set developed for this project have some key common data areas. There is more information from some of the large landowners than from the UVA source but the common data will be sufficient for analysis for determining the feasibility of siting a wood using industry on the site of the former Burke Lumber mill.

*Timber harvests*

Understanding the current harvest levels on acreage within the Sutton site procurement area is essential to the feasibility of sourcing wood for a new facility. The FIA dataset and New Hampshire timber harvesting information from the Report of Cut requirement of the NH Timber Tax law provided an initial view of harvest levels in the previous sections. The new and additional data in this section will be used to compare and contrast the larger datasets previously reviewed.

Harvest levels for the 91,000 average acres of owners under UVA that harvested from 2005-08 is 25 board feet of sawtimber per total owned acres and .65 tons[1] of pulpwood quality timber per acre owned. Total per acre volumes harvested in tons is .78 (combined sawtimber and pulpwood). This translates to an average of 7.3 million board feet of sawtimber and an additional 59,250 tons of pulp quality material or a total of 96,000 tons (combined sawtimber and pulpwood). Harvests on UVA lands are mandatory under the management plan approved for the program.

Harvest levels on the larger ownerships were similar, when put on a per acre basis. Most of these landowners were reluctant to provide information that included both sawtimber harvest levels and pulpwood. A general harvest level summary calculation was made in tons as a result. These 313,000 acres of land are producing .43 tons per acre (per total acres in the ownership) from harvests. This translates to approximately 155,000 tons per year. Summarizing the larger owner sawtimber data provided indicates that approximately 25% of the volume harvested on these ownerships is in the form of sawtimber and 75% in the form of pulpwood.

[1] Note: Many of the harvest levels discussed above were reported in cords by the original source. The conversion factor used for this report was: 1 cord = 2.5 tons.

**Table 4.** Summary Table – UVA landowner and Large landowner Annual Harvest Levels

| | (acres) | (acres) | (tons, all species) | (tons) | (tons, all species) | (tons, all species) |
|---|---|---|---|---|---|---|
| | Acreage of full ownerships where harvest occurred | available acreage | annual harvest | Addition. Vol. avail. if biomass[xi] | harvest/ac/yr | harvest/avail. ac/yr |
| **UVA lands** | 91934 | 78144 | 95,993 | 162,150 | 1.05 | 1.23 |
| **Large landowner lands** | 312842 | 265916 | 156,250 | 165,533 | 0.5 | 0.6 |
| | | | | | | |
| **TOTALS** | **404776** | **344060** | **252,243** | **327,683** | | |

Lastly, it is clear that very little whole tree harvesting is occurring in the proposed procurement region for the Sutton site. It is common knowledge among foresters and loggers that adding whole tree harvesting (and with no additional trees harvested on a logging operation) will add an additional 20-40 tons of biomass chips per acre from the same operation with no chipping occurring. Assuming the low end of this range, the lands in question from the UVA and large landowner datasets could produce an additional 325,000 tons of wood each year by adding chipping capability. Even if more conservative estimates are drawn from this concept, a significant amount of additional low quality biomass, primarily left on the ground in current harvests, can be produced with the addition of chipping capability to operations.

5.5 Standing Timber Volumes

Information on standing timber volumes from the UVA and large landowner dataset was less robust than the harvest data reported on. Nevertheless, standing volume information is helpful, especially as it relates to growth rates and sustainable harvest levels.

Standing timber volumes for both UVA and large owner data sets previously described range from 14 – 22 cords per acre[xii]. No average can be calculated that will give meaning since data is not available in a form that allows this. This data is helpful anyway. A considerable number of acres in these datasets could be considered understocked in silvicultural terms. As evidenced by actual harvest levels, the harvests on many of these acres are taking this into account and are at levels consistent with stocking. In many cases harvest levels are below net annual growth, allowing for increasing standing inventories over time.

5.6 Relationship of Net Growth to Standing Timber Volumes and Harvest Levels

FIA data sources suggest an average net annual growth among all species of trees at approximately 1.4%. Some species experience net growth considerably higher than this average and some lower. Harvest levels on the UVA and large landowner lands indicate that on average, the harvest levels on the UVA lands harvested in the last three years along with the levels for the large landowners are approximately at gross growth, the level of growth before harvesting is accounted for. The actual annual harvest levels for the UVA lands, however, are less than gross growth because the data used for this analysis is for UVA lands harvested in the years cited. Assuming that UVA lands are harvested at 10 to 15 year cutting cycles reduces the annualized levels considerably. Large landowner harvest levels are already based on actual annual harvest levels. Harvest levels on UVA lands are at approximately 2.3% of standing volume (not including tops and branches) in the year the harvest occurs while the large landowner harvest levels are at 1% of standing volume (not including tops and branches).

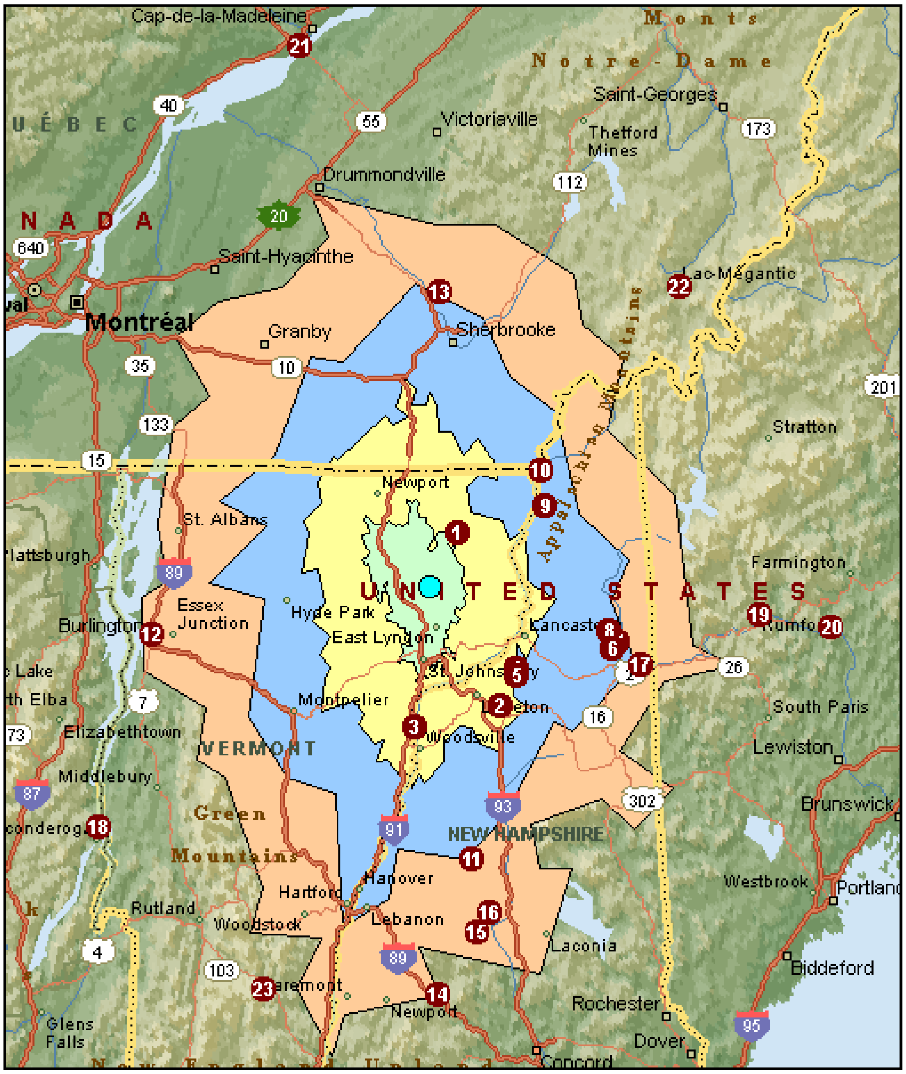
This suggests that current harvest levels are sustainable within the Sutton procurement area – i.e. are at or less than gross growth levels that allows for additional harvesting since net growth is a positive number. Further, top and branch wood is additional volume (a substantial amount as suggested above) that could be harvested to provide additional volumes in the procurement area without harvesting additional acres or trees. This is a substantial finding.

The datasets for the Use Value Assessment lands in Caledonia and Essex Counties, Vermont that were analyzed re-affirm the conclusions drawn from the USDA Forest Service Forest Inventory and Analysis data reviewed for the entire procurement area envisioned for the Sutton, Vermont site. Basically, harvest levels in this region, that also includes substantial lands in New Hampshire, are at or below gross growth levels indicating sustainable levels can be maintained if the wood for any new facility(ies) at the Sutton site utilize wood from the net growth increment and from existing harvests in the area. If tops and branches could be better utilized in the region (especially in Vermont where it appears that very little whole tree harvesting is occurring) then additional volumes of wood could be delivered to a Sutton facility with no additional timber harvesting required.

## 6. Market Demand and Competition for Low-Grade Wood

Within a two hour drive time there are seventeen current or proposed major users of low-grade wood (pulpwood, biomass chips, or similar non-sawlog products), as well as several more large wood-using facilities slightly outside of the two-hour drive time that are or could be major markets for low-grade wood from the region surrounding Sutton.

**Figure 4.** Nearby Competitors for Low-Grade Wood, 30-60-90-120 Minute Drive Time




### 60 Minute Drive Time

| | |
|---|---|
| **Facility 1** | Vermont Pellet Fuel Corporation |
| **Location** | Island Pond, VT |
| **Status** | Proposed |
| **Product** | Wood Pellets |
| **Owner** | Privately held |
| **Annual Wood Use (est.)** | 80,000 green tons of roundwood |
| **Road Miles** | 17 |
| **Drive Time** | 31 minutes |

| | |
|---|---|
| **Facility 2** | 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 green tons |
| **Road Miles** | 44.5 |
| **Drive Time** | 50 minutes |

| | |
|---|---|
| **Facility 3** | 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 |
| **Road Miles** | 33.5 |
| **Drive Time** | 42 minutes |

| | |
|---|---|
| **Facility 4** | DG Whitefield LLC |
| **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 green tons |
| **Road Miles** | 50 |
| **Drive Time** | 58 minutes |

| | |
|---|---|
| **Facility 5** | Whitefield Pellets |
| **Location** | Whitefield, NH |
| **Status** | Proposed |
| **Product** | Wood pellets |
| **Owner** | Privately held |
| **Fuel** | Roundwood |
| **Annual Wood Use (est.)** | 50,000 green tons |
| **Road Miles** | 50 |
| **Drive Time** | 58 minutes |

**90 Minute Drive Time**

| | |
|---|---|
| **Facility 6** | Greenova Pellets |
| **Location** | Berlin, NH |

| | |
|---|---|
| **Status** | Proposed |
| **Product** | Wood pellets |
| **Owner** | Greenova / Woodstone |
| **Fuel** | Roundwood, sawmill residue |
| **Annual Wood Use (est.)** | 400,000 green tons |
| **Road Miles** | 54 |
| **Drive Time** | 1 hour, 26 minutes |

| | |
|---|---|
| **Facility 7** | Laidlaw EcoPower – Berlin |
| **Location** | Berlin, NH |
| **Status** | Proposed |
| **Product** | Electricity |
| **Owner** | Laidlaw Energy Group |
| **Size** | 65 MW |
| **Fuel** | Whole tree chips, sawmill residue, pallets |
| **Annual Wood Use (est.)** | Up to 750,000 green tons (some imported via rail) |
| **Road Miles** | 54 |
| **Drive Time** | 1 hour, 26 minutes |

| | |
|---|---|
| **Facility 8** | Clean Power - Berlin |
| **Location** | Berlin, NH |
| **Status** | Proposed |
| **Product** | Electricity |
| **Owner** | Clean Power Development |
| **Size** | 25 MW |
| **Fuel** | Whole tree chips, sawmill residue, pallets |
| **Annual Wood Use (est.)** | 340,000 green tons |
| **Road Miles** | 54 |
| **Drive Time** | 1 hour, 26 minutes |

| | |
|---|---|
| **Facility 9** | Colebrook Woodyard |
| **Location** | Colebrook, NH |
| **Status** | Operating |
| **Product** | Concentration yard for roundwood, mulch production |
| **Owner** | Privately held |
| **Road Miles** | 46 |
| **Drive Time** | 1 hour, 5 minutes |

| | |
|---|---|
| **Facility 10** | Ethan Allen |
| **Location** | Beecher Falls, VT |
| **Status** | Operating |

| | |
|---|---|
| **Product** | Electricity and thermal energy |
| **Owner** | Ethan Allen |
| **Size** | 1.5 MW |
| **Fuel** | Whole tree chips, sawmill residue |
| **Annual Wood Use (est.)** | 20,000 green tons |
| **Road Miles** | 48 |
| **Drive Time** | 1 hour, 10 minutes |

**120 Minute Drive Tim**

| | |
|---|---|
| **Facility 11** | King Forest Industries |
| **Location** | Wentworth, NH |
| **Status** | Operating |
| **Product** | Pulp chips |
| **Owner** | King Forest Industries |
| **Fuel** | Roundwood |
| **Annual Wood Use (est.)** | 150,000 green tons |
| **Road Miles** | 81 |
| **Drive Time** | 1 hour, 32 minutes |

| | |
|---|---|
| **Facility 12** | 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) |
| **Road Miles** | 93 |
| **Drive Time** | 1 hour, 51 minutes |

| | |
|---|---|
| **Facility 13** | Domtar – Windsor Mill |
| **Location** | Windsor, PQ, Canada |
| **Status** | Operating |
| **Product** | Paper |
| **Owner** | Domtar Corporation |
| **Annual Wood Use (est.)** | 2.2 million green tons of pulpwood |
| **Road Miles** | 83 |
| **Drive Time** | 1 hour, 34 minutes |

| | |
|---|---|
| **Facility 14** | DG Hemphill LLC |
| **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 green tons |
| **Road Miles** | 100 |
| **Drive Time** | 1 hour, 55 minutes |

| | |
|---|---|
| **Facility 15** | Alexandria Power |
| **Location** | Alexandria, NH |
| **Status** | Operating (re-started 2008) |
| **Product** | Electricity |
| **Owner** | Indeck |
| **Size** | 16 MW |
| **Fuel** | Whole-tree chips and sawmill residue |
| **Annual Wood Use (est.)** | 200,000 tons |
| **Road Miles** | 102 miles |
| **Drive Time** | 1 hour, 52 minutes |

| | |
|---|---|
| **Facility 16** | Bridgewater Power & Light |
| **Location** | Bridgewater, NH |
| **Status** | Operating |
| **Product** | Electricity |
| **Owner** | PSEG |
| **Size** | 17 MW nameplate |
| **Fuel** | Whole-tree chips and sawmill residue |
| **Annual Wood Use (est.)** | 225, 000 tons |
| **Road Miles** | 96 miles |
| **Drive Time** | 1 hour, 44 minutes |

| | |
|---|---|
| **Facility 17** | R.J. Chipping |
| **Location** | Shelburne, NH |
| **Status** | Operating |
| **Product** | Pulp chips |
| **Owner** | Privately held |
| **Fuel** | Roundwood |
| **Annual Wood Use (est.)** | 300, 000 tons |
| **Road Miles** | 70 miles |
| **Drive Time** | 1 hours, 31 minutes |

**Other Proximate Wood Users of Significance**

| | |
|---|---|
| **Facility 18** | Ticonderoga Mill |
| **Location** | Ticonderoga, NY |
| **Status** | Operating |
| **Product** | Paper |
| **Owner** | International Paper Company |
| **Annual Wood Use (est.)** | 400,000 green tons of pulpwood<br>80,000 green tons of biomass |
| **Road Miles** | 138 |
| **Drive Time** | 2 hours, 47 minutes |

| | |
|---|---|
| **Facility 19** | New Page – pulp and paper mill |
| **Location** | Rumford, ME |
| **Status** | Operating |
| **Product** | Paper |
| **Owner** | New Page |
| **Annual Wood Use (est.)** | Estimated at 2 million tons of pulpwood use annually, plus 240,000 green tons of biomass |
| **Status** | Operating |
| **Road Miles** | 109 |
| **Drive Time** | 2 hours, 17 minutes |

| | |
|---|---|
| **Facility 20** | Androscoggin Mill |
| **Location** | Jay, ME |
| **Status** | Operating |
| **Product** | Paper |
| **Owner** | Verso Paper |
| **Annual Wood Use (est.)** | Pulpwood estimated at 2 million tons annually<br>Biomass 275,000 green tons |
| **Road Miles** | 135 |
| **Drive Time** | 2 hours, 55 minutes |

| | |
|---|---|
| **Facility 21** | Kruger – Three Rivers |
| **Location** | Trois Rivieres, Quebec |
| **Status** | Operating |
| **Product** | Paper |
| **Owner** | Kruger |
| **Annual Wood Use (est.)** | |
| **Status** | Operating |
| **Road Miles** | 156 |
| **Drive Time** | 2 hours, 53 minutes |

| | |
|---|---|
| **Facility 22** | Tafisa – Megantic |
| **Location** | Lac Megantic, Quebec |
| **Status** | Operating |
| **Product** | Particleboard |
| **Owner** | Tafisa |
| **Annual Wood Use (est.)** | |
| **Status** | Operating |
| **Road Miles** | 122 |
| **Drive Time** | 2 hours, 35 minutes |

| | |
|---|---|
| **Facility 23** | Access Ludlow Clean Energy Project, LLC |
| **Location** | Ludlow, VT |
| **Status** | Proposed |
| **Product** | Electricity |
| **Owner** | Access Energy / US Renewables Group |
| **Size** | 25 MW |
| **Fuel** | Whole-tree chips, sawmill residue |
| **Annual Wood Use (est.)** | 315,000 tons |
| **Road Miles** | 115.5 |
| **Drive Time** | 2 hours, 11 minutes |

Within a 30 minute drive time, there are no major facilities actively using large volumes of low-grade wood. As the drive times get longer, it is apparent that an increasing number of facilities are economically available markets for low-grade wood from the Sutton procurement zones. However, the largest existing markets, particularly for roundwood, are located well outside the immediate drive time around Sutton, VT, and pulp mills that draw from this region are in the 120 minute drive time or further. <u>This presents an opportunity to compete economically for existing harvest volume, given the shorter trucking distance that allows for less fuel cost, less truck cost, and more deliveries per day.</u> A modestly sized facility in Sutton (for example, less than 300,000 green tons) would be well positioned to capture some existing harvest volume and to potentially encourage new harvest and/or tops and branches through whole tree harvesting.

It should be noted that there are public proposals for other new low-grade wood using facilities, including pellet manufacturing facilities, in the region surrounding the Sutton site. Depending on the location of the competing facilities and the price of low-grade wood, this may affect wood availability. It is impossible to predict which of these facilities will be built (if at all) since they are all at the early announcement stage of development.

**Table 5.** Proposed and Operating Low-Grade Wood Using Facilities, by Drive Time

| Facility | Status | Wood Type (Primary) | Current (Green Tons) | Potential (Green Tons) |
|---|---|---|---|---|
| **60 Minute Drive Time** | | | | |
| Vermont Pellet Fuel Corporation | Proposed | Roundwood | - | 80,000 |
| Pinetree - Bethlehem | Operating | Biomass | 230,000 | 230,000 |
| Pinetree - Ryegate | Operating | Biomass | 260,000 | 260,000 |
| DG Whitefield | Operating | Biomass | 180,000 | 180,000 |
| Whitefield Pellets | Proposed | Roundwood | - | 50,000 |
| *Subtotal* | | | *670,000* | *800,000* |
| **90 Minute Drive Time** | | | | |
| Greenova Pellets | Proposed | Roundwood | - | 400,000 |
| Laidlaw - Berlin | Proposed | Biomass | - | 750,000 |
| Clean Power - Berlin | Proposed | Biomass | - | 340,000 |
| Ethan Allen - Co-Gen | Operating | Biomass | 20,000 | 20,000 |
| *Subtotal* | | | *20,000* | *1,510,000* |
| *Running Total* | | | *690,000* | *2,310,000* |
| **120 Minute Drive Time** | | | | |
| King Forest Industries | Operating | Roundwood | 150,000 | 150,000 |
| McNeil Station | Operating | Biomass | 600,000 | 600,000 |
| Domtar - Windsor | Operating | Roundwood | 2,200,000 | 2,200,000 |
| DG Hemphill | Operating | Biomass | 200,000 | 200,000 |
| Alexandria | Operating | Biomass | 200,000 | 200,000 |
| Bridgewater Power | Operating | Biomass | 225,000 | 225,000 |
| R.J. Chipping | Operating | Roundwood | 300,000 | 300,000 |
| *Subtotal* | | | *3,875,000* | *3,875,000* |
| *Running Total* | | | *4,565,000* | *6,185,000* |
| **Other Facilities** | | | | |
| I.P. - Ticonderoga | Operating | Roundwood | 480,000 | 480,000 |
| New Page - Rumford | Operating | Roundwood | 2,240,000 | 2,240,000 |
| Verso- Androscoggin | Operating | Roundwood | 2,227,000 | 2,227,000 |
| Access Energy - Ludlow | Proposed | Biomass | 315,000 | 315,000 |
| *Subtotal* | | | *5,262,000* | *5,262,000* |
| ***Total*** | | | ***9,827,000*** | ***11,447,000*** |

## 7. Wood Availability

Sutton, Vermont is in a region with significant forest resources. The region has net growth available and is sufficiently distant from most existing large users of low-grade wood – particularly roundwood – that an appropriately scaled project could capture some level of current harvest volume and potentially incent new harvest activity.

If seventy percent of the roundwood volume from timber harvests in the region is pulpwood[xiii], the annual volume of low-grade roundwood harvested in the core counties is roughly 675,000 green tons, and 2.3 million green tons when the buffer counties are included. Given the distance to major existing roundwood markets from Sutton, an opportunity clearly exists to capture some of this volume. Capture of a third would be a reasonable preliminary assumption, meaning that 225,000 green tons is likely available from existing harvest. Additionally, growth in excess of historic harvest levels (net growth) for the core counties is roughly 357,000 green tons. If a local market for low-grade roundwood was developed, a reasonable preliminary assumption is that twenty percent of this volume, or 71,000 green tons, could be captured. Given these realities, an early estimate of roundwood available for a manufacturing facility in Sutton is roughly 300,000 green tons per year. This volume could be increased by paying highly competitive rates for wood, or by reaching outside of the core counties (meant to approximate a 60-minute drive time) to procure volume.

Additionally, 191,000 green tons of biomass fuel is theoretically available from the core counties. Capture of this volume of wood may prove difficult, given existing proximate markets for biomass fuel, as well as the likely need for significant new logging infrastructure purchases (e.g., chippers and chip vans) in order to capture this volume.

INRS considers these estimates of wood availability to be conservative so as to give assurances that a reasonably sized facility will have adequate wood supplies. For instance, it may be possible to capture one-half of the volume of pulpwood currently traveling to other facilities, especially if diesel fuel prices return to the high levels experienced earlier in 2008. It may also be likely that 40% of the net growth in the region not currently harvested may be captured if a new market exists, especially if roundwood deliveries (which would grant access to more wood producers into this new market) are allowed. Other factors could increase availability. INRS prefers to remain with its conservative estimate, however.

## 8. Wood Pricing

A full pricing analysis for roundwood and biomass has not been completed for the region, and is expected once a product type and rough volume have been established. However, it is critical to note that pricing for wood, particularly low-grade wood, is extremely difficult to predict with any level of certainty, and that historically wood supply for regional wood-using facilities have operated on spot-market purchases (with the exception of company-owned timberland for pulp and paper mills; company lands no longer exist in New England.) Prices that exist at any given period of time can change based upon a large number of factors:

- **Diesel costs** are one of the largest single inputs to forest-derived wood. Every step of the process – felling, skidding, chipping and transport – uses diesel to power machinery. As diesel costs have risen, low-grade wood prices have risen as well. As such, shorter trucking distances or other fuel conservation measures may allow moderation of pricing. For biomass chips, wood travelling 60 miles has an input of roughly 2.25 gallons of diesel per ton of wood; for pulpwood, the diesel input is estimated to be 1.85 gallons for each ton of delivered pulpwood from the same distance.

- The **wholesale price of electricity**, set largely by natural gas plants, significantly impacts the ability of existing and new wood-fired power plants to operate profitably. As natural gas prices have climbed, and demand for Renewable Energy Certificates (RECs) has grown in the region, a number of developers have proposed new, greenfield biomass plants. In INRS' view, most of these facilities will not be constructed.

- The increasing use of wood in the region as **firewood** and as a pellet feedstock is causing competition for wood that might otherwise be available for biomass power applications.

- **Logging and other supply infrastructure** is critical to the success of low-grade wood markets. The presence of wood is a necessary but insufficient component of supply to a facility; the people, companies, processing equipment, and transport need to be in place. At this time, the region's supply infrastructure is sufficient for roundwood harvesting, but likely needs improvement in order to procure large volumes of biomass.

- In New England, a large volume of wood used at pulp and paper mills and biomass plants can be expected to come from **land clearing**. While Sutton, VT is distant from concentrations of such activity, and as such would not expect large volumes of wood from land clearing activity, competitors to the south and east do rely on such wood; when it is unavailable, and they can be expected to compete more directly with a facility in Sutton. Housing starts and other development activity have a history of being cyclical.

- Specific and localized **weather events**, such as the high levels of precipitation seen across New England in 2008, can have a meaningful short-term impact on the availability and price of low-grade wood.

## 9. Potential Site Use Recommendations

Based upon the above information on wood availability, as well as INRS knowledge of market conditions for products made from low-grade wood, the following options are available for further development at the Sutton site. Below please find a brief description of the options available, with recommendations for action.

### 9.1 Pellet Manufacturing

Wood pellets are a refined fuel that can be used in thermal and industrial applications. Wood pellets have grown significantly in popularity in the past several years, and press reports in the region warn of a shortage of wood fuel this winter. Pellets are generally manufactured using sawmill residue and roundwood, which is debarked, chipped, ground and dried prior to processing into pellets. The bark from de-barking is often used as fuel for the dryer, providing an immediate outlet for bark and a low-cost renewable fuel for drying operations. While specifics vary considerably by size, equipment manufacturers, and other factors, a pellet mill can be expected to cost in the range of $10 million to $12 million for a facility that produces 100,000 tons of wood pellet annually. Such a facility would use roughly 200,000 green tons of roundwood or other suitable feedstock, and provide direct employment to around 25 individuals.

**Strengths**: The facility is distant from major markets for low-grade wood, and has a history of timber harvesting and forest management. The region appears capable of supplying the volume of wood necessary to support a pellet manufacturing site (200,000 to 400,000 green tons), and little major changes to the region's logging infrastructure would be necessary. The presence of rail at the site could be useful for both the import of roundwood from outside the region and the export of pellets in bulk form to distant markets; no direct exploration of these options has been made. At least one firm with interest in pellet manufacturing has expressed interest in this site.

**Weaknesses**: Sutton is not located in a region of New England proximate to major residential and institutional markets; as such pellets would need to be shipped some distance to their final destination. While pellet market growth has been significant to date, recent changes in the price of oil may curb some enthusiasm for this developing market, and provide a near-term challenge for project developers.

**Recommendation**: The size and supply infrastructure needs of a pellet manufacturing facility are well suited to the region around Sutton, Vermont. The fact that most major roundwood markets (pulp and paper mills) are in excess of 120 minutes from the Sutton site is very positive; it allows a new, modestly sized consumer the ability to secure volume utilizing existing infrastructure. We recommend further pursuit of this option.

### 9.2 Biomass Electricity

The use of wood to generate electricity is well established in the region; facilities exist in Ryegate and Burlington, VT, as well as a number of other facilities in New Hampshire proximate to the site. Biomass electricity is eligible for Renewable Energy Certificates from a number of New England markets, as well as a federal production tax credit. The presence of these price supports, which can add revenue beyond the price paid for electricity to up to $70 per megawatt hour of generation, has increased interest in development of these projects in the region. However, while dozens of projects have been publicly announced in New England, no greenfield plant has been constructed in roughly twenty years, and only one new biomass plant exists in the region – a converted coal unit owned by a regulated utility. Given the existing markets for biomass proximate to Sutton, it is not clear that large volumes of biomass could be economically captured at this site; a facility further to the west or south may be an ideal location. While biomass plants can be any size, current development activity is concentrated in the 25 MW to 50 MW size, in order to achieve economies of scale for capital and operations. At roughly 13,000 green tons of wood use per installed MW, this would mean a facility using 325,000 to 650,000 green tons of biomass chips annually. While prices can vary by technology, vendor, size and other factors, greenfield biomass development generally cost $3 million to $5 million per installed MW; or $75 million to $125 million for a 25 MW facility. A typical biomass plant directly employs roughly 25 people.

**Strengths:** Regional markets for electricity, as well as public supports from Renewable Energy Certificates and the federal Production Tax Credit, offer meaningful incentives for biomass development. Many states in the region have stated goals of increasing the generation of renewable electricity production, and biomass presents a clear opportunity to accomplish this in Vermont and other parts of New England. At least one firm with interest in biomass electricity generation has expressed interest in this site.

**Weaknesses:** Sutton is in an area proximate (less than 60 minutes) to a number of biomass markets, and any facility built here would compete directly for supply. In order to secure large volumes of biomass, new logging infrastructure – particularly chipping / grinding and transport capacity – would need to be built. It is not clear that this site is well positioned for large volumes of biomass chips, and smaller facilities are increasingly rejected by financial institutions as uneconomic. Recent escalation in capital costs places another hurdle in the way of the financing, construction and operation of a biomass plant at this site.

**Recommendation:** At this level, it is hard to see biomass electric production as the most attractive use of this site for low-grade wood use. While it is not impossible that the economics can support such a project, the volume of wood likely needed coupled with high capital cost and the need for new logging infrastructure make this a greater challenge than pellet manufacturing.

### 9.3 Concentration and Chipping Yard for Low-Grade Wood

A concentration yard is a location where wood is brought from a number of suppliers and sorted by product, often for a number of markets. Concentration yards that specialize in the handling of low-grade wood – usually pulpwood – exist in New England, and the facilities at Shelburne, NH (RJ Chipping) and Wentworth, NH (King Forest Industries) are examples of such. A site can either aggregate, sort, store and ship roundwood; it can also engage in value-added activity such as producing pulp chips for one or more customers. The capital costs at a chipping yard are generally less than $2 million, depending upon the volume and range of products produced; roughly five people are directly employed. Likely markets for a low-grade chipping yard would be pulp and paper mills, bark mulch users, biomass plants specifying roundwood chips (e.g., schools), and pellet manufacturers.

**Strengths:** The fact that major markets for pulp chips exist to the north, east and west provides an opportunity to supply a range of markets from this location. Further, proposed pellet manufacturers in the region, if built, would be strong potential customers. Increases in the number of institutions using biomass thermal energy could be another market, though these projects are individually small and Sutton is not in a region with a high local concentration of population and thus institutions. The rail located on-site may provide some shipping options, but does not run directly to pulp markets in New York or Maine, limiting its potential effectiveness. The capital invested in a site, while not truly mobile, can be re-located, and as such does not represent a fixed investment risk like pellets and biomass electric. The flexibility in sizing is a very attractive feature for this location.

**Weaknesses:** While there are a number of potential core customers owned by a number of firms, almost all are concentrated in the paper industry. If a couple of large pulp mills in the region fail, Sutton could find itself at the economic edge of a procurement radius, and limit its market options. Similarly, since it is over 120 minutes to most major chip markets, a return to high diesel prices could make this site unattractive from a pulp chip supply perspective. The economic activity and investment created through a concentration yard are minimal when compared to a pellet manufacturing facility or a biomass electric plant. Some successful chipping facilities, such as those at HHP in Henniker, NH or King Forest Industries in New Hampshire, exist at and share resources with operating sawmills; no such economy of scale exists in Sutton. INRS is not aware of any firms that have expressed an interest in this site for this purpose.

**Recommendation:** INRS views a concentration yard with chipping as possible, though with limited economic return for the region. While the barrier to entry is low compared to other markets, there is limited economic benefit that would come to the region through such an investment. If this option is selected for further study, INRS recommends combining this with the establishment of a "core customer", an operation such as kiln-dried firewood, which would serve to increase economic activity and buffer market changes from distant customers.

# Phase II & III – Wood Pellet Manufacturing Facility Feasibility Analysis & Business Plan

### 10. Input Products

The feasibility analysis and business plan for a wood pellet mill is focused on the conversion of low-grade timber (wood from the local forest that is not easily marketable to local forest products mills or is better suited to use at the Sutton site than other sites in the region) into premium grade wood pellets that would be used to heat homes and small businesses in stoves, boilers and furnaces designed specifically for wood pellet use. Premium grade wood pellets are manufactured with a standard of less than 1% ash content and less than 0.5% fines[2]. With manufacturing capability to these standards, the facility could also manufacture lower standard wood pellets for industrial markets. The lower quality product would allow for lower quality raw wood inputs that include bark. While this lower quality input and output is a possibility, this analysis and plan is focused on the premium product output.

With volatile oil and gas prices, and improved consumer understanding of wood pellet use, the premium wood pellet supply available in North America is not adequate to meet current and future demand. There were 55,000 pellet stoves sold in the U.S in 2007 and approximately 100,000 in 2008.[3] Over 800,000 households in the United States are now using wood pellets as a source of heat. Additionally several thousand commercial units are installed. Pellet boilers, designed to replace or co-locate with traditional gas and oil boilers for residential and commercial uses, are also increasing rapidly. The American Recovery and Reinvestment Act of 2009 includes a provision for a 30% tax credit up to $1500 for consumers who purchase an at least 75% efficient wood or pellet burning stove. It is estimated that this incentive will spur on thousands of pellet stove purchases and boiler conversions in the U.S. in the coming years.

Pellet sales, at approximately 1 million tons per year in the U.S. currently, are expected to rise between 10-20% per year in the next several years[4]. Pellet demand is covered later in this paper.

At present the average pellet stove consumes approximately three tons of pellets per heating season while a pellet boiler will use approximately double this amount to heat a typical home. The prospects for wood pellet sales are good over the next several decades given the:

- Increasing fossil fuels prices (despite the roller coaster 2008 prices)
- Increased sales of wood pellet stoves, boilers and furnaces and
- The new federal tax incentive to encourage wood pellet use for thermal applications.

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[2] Pellet Fuels Institute & Hearth, Patio and Barbecue Association
[3] ibid
[4] New England Wood Pellet, Pellet Fuels Institute

Data does not exist for regional sales of pellet stoves, boilers and furnaces, but those in the business believe that the northeastern United States is a prime market for all of these.

## 10.1. Raw Material Supply

The wood pellet manufacturing plant at the Sutton, Vermont site will obtain its raw material through two purchase methods: the purchase of log length low-grade wood from local logging contractors and then conversion of this material at the plant site to wood chips; and the direct purchase of clean chips, i.e. chips without bark. Most of the purchases are expected to be in roundwood form. Whole tree chips will not be purchased as a raw material source. All species will be accepted and purchased on weight.

**10.1.1 Sources** - The largest cost of low-grade wood is transportation. Wood for this facility will be purchased largely within a 60-mile radius of the Sutton site with a concentration within a 30 mile radius (or 60 minute drive-time from the facility) . Many contractors in this radius are currently transporting wood to pulp mills, wood concentration yards and other markets that are beyond sixty miles. Of course, reduced trucking costs may provide an advantage for loggers and producers. A full analysis of the wood sourcing for this facility can be found within the Phase I section above.

**10.1.2 Pricing of raw material** – Pricing of purchased log-length wood into the Sutton facility would be competitive with pulp mills and biomass plants. The cost per ton of roundwood delivered to the site is expected to be between $40.00-50.00/per green ton. This is competitive with existing pulp mill markets, the most significant sector competitor for raw material. The wood pellet plant financial analysis assumes wood purchases at $50.00/green ton.

Currently there are no pellet manufacturing operations buying log length wood to process into wood pellets in the region. There are many existing (and a few proposed) facilities within the raw material procurement area for the Sutton site that would be considered competitors for raw material. Table 5 above shows these sites organized by drive time distance from the proposed facility. Those within 60 minutes would be considered the most direct competitors.

**10.1.3 Competition and other factors affecting raw material procurement –** A healthy set of competitors for the log length raw material that is to be the source of raw material for the wood pellet plant is, in one sense a good thing. Many competitor markets for these products help assure adequate production capacity in the logging business infrastructure – to a point. Price competition among the competing markets of wood energy plants and pulp mills would likely be the biggest competitive factor for the material, not availability from the forest. If the developer/operator of the wood pellet mill at the Sutton site is able to pay adequately (at the $50/green ton level), then adequate wood will be there to source the facility.

While all the raw material designed to supply this plant will be purchased from open market sources[5], this market has flourished for over 100 years and has shown steadiness and reliability of supply for decades, given sufficient pricing.

Seasonal weather phenomena and other factors[6] are well known in the timber business world in the northeastern U.S. Very typically, spring break-up and thaw results in a downturn of supply. During this time, when soils go from their frozen winter state to unthawed warm-weather conditions, many forests are not accessible due to environmental concerns. A similar season may also occur in the fall before the onset of winter "freeze-up". Markets typically pre-buy or increase their purchases and delivery of timber products during those periods before the two weather seasons curtail supply. Some seasonal price fluctuations occur since supply is reduced during those periods, but businesses that anticipate this change in the market can avoid being affected by severe cost fluctuations by managing adequate and increased supply during those pre-seasons when logging conditions are good.

**10.1.4 The procurement radius** – It is expected that a procurement radius of an approximately 60 minute drive time from the Sutton facility will be needed to purchase supplies of log-length and clean chip wood for the plant. Figure 1 above shows this projected area.

### 10.2 Electricity issues

Although a sawmill operated on the Sutton site for many years, 3-phase power, essential for powering the large electric motors necessary in a wood pellet mill, is not currently available from the local electricity provider (Lyndonville Electric Department). Harry Abendroth of Vermont Electric Cooperative (802-730-1142) indicated that VEC would be willing to extend 3-phase power to the site from the Portland Pipeline pumping station 5 miles to the north, at an estimated cost of $500,000 per mile, provided that the Lyndonville Electric Department approves. This option may be economically prohibitive given the distance involved, so other options should also be explored.

To take this infrastructure shortcoming into account for this feasibility study, the financial analysis found later in this report assumes that power will cost .18/kwh, significantly higher than market price of .10/kwh or less. This increase is intended to simulate the cost to provide 3-phase power to the site. The developer will have to determine whether to pay for the capital cost of bringing in 3-phase power through the electricity provider, or to generate power on site. In any event, this additional cost is taken into account in the *pro forma* financials.

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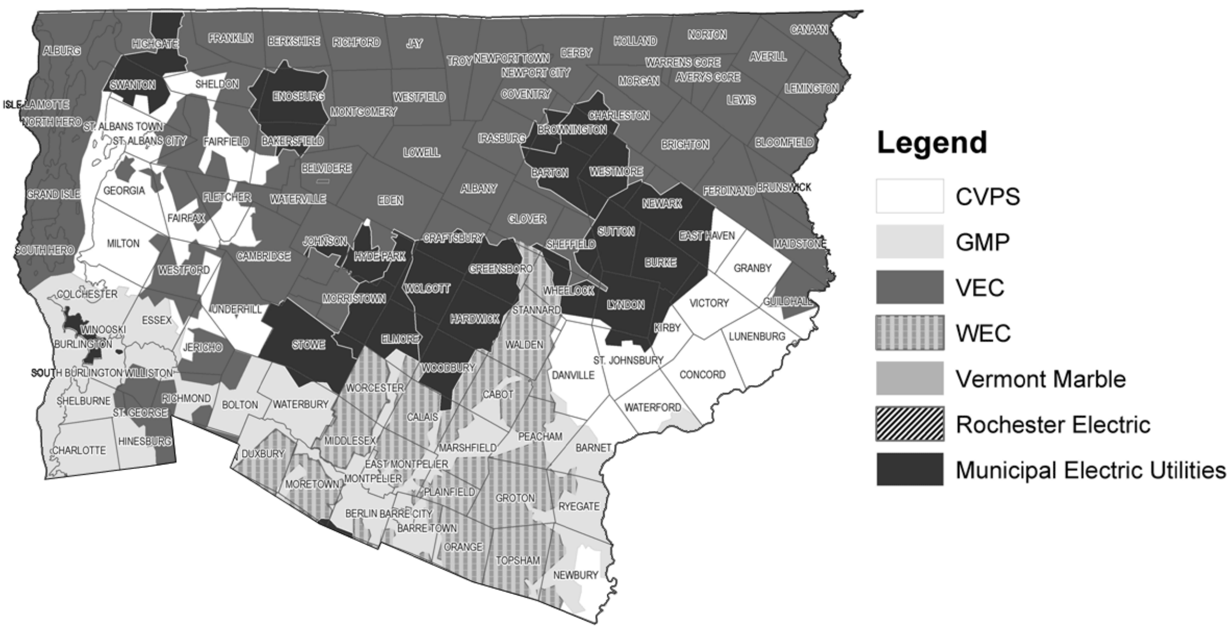
[5] The logging business infrastructure is populated in this region of the United States (as in many others) with hundreds of small independent logging businesses who obtain timber through purchases from landowners in a competitive market scenario. A smaller percentage of logging companies may own their own forest land from which trees are harvested. A third component is the larger forest landowner who, as businesses unto themselves, sell timber to markets but hire loggers under contract to cut and truck this timber to markets of the landowners' choosing.

[6] see Phase I report for details on these issues

**Figure 5. Electricity service to Sutton / Burke - part of the Lyndonville Electric Dept.**




## 11. Manufacturing Process – Part I: Raw Material Re-manufacturing

It is anticipated that the manufacturing process to produce wood-pellets will occur in two-stages. The Sutton facility will purchase raw material in log-length form, as described in the previous section, for the bulk of its sourcing. This material will have to be converted into clean wood chips before it will be available for secondary manufacturing into wood-pellets.

Initial start-up of the pellet plant will have the capacity to produce approximately twelve tons of finished product per hour on a seven-day, twenty-four hour operation. Annual capacity would be approximately 100,000 tons of finished product. Raw material to source this facility would be approximately 200,000 tons of mostly green roundwood hardwood and softwood delivered to the facility.

### 11.1. Receiving

The receiving process will start as trucks with log length, low-grade timber arrive at the **scale**[7]. A truck scale exists at the current site, but that scale will be replaced with a 70 foot aboveground unit that permits efficient in-and-out weighing.. Trucks will register the gross weight, monitored by the scale operator, and then unload in the yard at a designated location (see possible mill site layout later in this report). Trucks with self-loaders will unload themselves. A **yard loader** will unload trucks without self-loaders. A single yard loader operator will serve this function. Loader operations will be located behind the warehouse and pellet mill buildings to decrease noise impact. Log-length wood will be stored in the debarking/chipping area. Empty trucks will exit over the scale to register net weight of logs unloaded. Trucks will deliver fifteen to thirty tons per load. The average will be twenty-two tons, resulting in approximately 25-30 trucks per day delivering wood to the yard, 6 days per week, or 30-35 trucks on a 5-day delivery week. Up to 60 trucks per day will be accommodated directly before spring breakup, which lasts up to 40 days in the Sutton area. The **scale house** will be open from 6:00am to 6:00pm Monday through Friday. Wood suppliers will be paid weekly.

Total area used for wood supply storage will be approximately 25,000 square feet with logs being stacked 12 feet high. This area will hold 5.5 days of consumption. Additional space will need to be available for seasonal surges. The site has more than adequate overflow area for additional log storage. It is anticipated that pre-mud season on-site supply will reach 20+ days of wood at peak.

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[7] Words in bold in this section identify equipment needs for the manufacturing facility.

**Figure 6. Typical chip scale, dumping and loading area for wood pellet plant (no roundwood capability). The Sutton site will not include the dumping equipment but will include the storage equipment seen in the background and conveying equipment seen in the foreground.**

(Courtesy N.E. Wood Pellet, Schuyler, NY)

### 11.2 Debarking/Chipping

The yard area will include a drum debarker and chipper and will have the capacity to process up to 100 tons per hour or 4000 tons per week during a 40-hour work week schedule. If more capacity is needed, shifts can be lengthened or a 2nd shift can be added for a portion of the week. This schedule allows time for maintenance and unloading trucks without self-loaders. Also this will confine exterior noise in the operation generally to daylight hours and should not have a negative impact on abutters.

The log length wood will be loaded onto the in-feed conveyor of the drum debarker by the yard loader (a single employee). The conveyor will feed the logs into the debarker, where they will be stripped of bark. This process is necessary to ensure low ash pellet production. The debarker operates on 100HP. As the debarked log leaves the debarker it will enter a **chipper** that will produce 3/8 size chips. The chipper operates on a 400HP motor.

An operator will also be required for the drum debarker and the chipper.

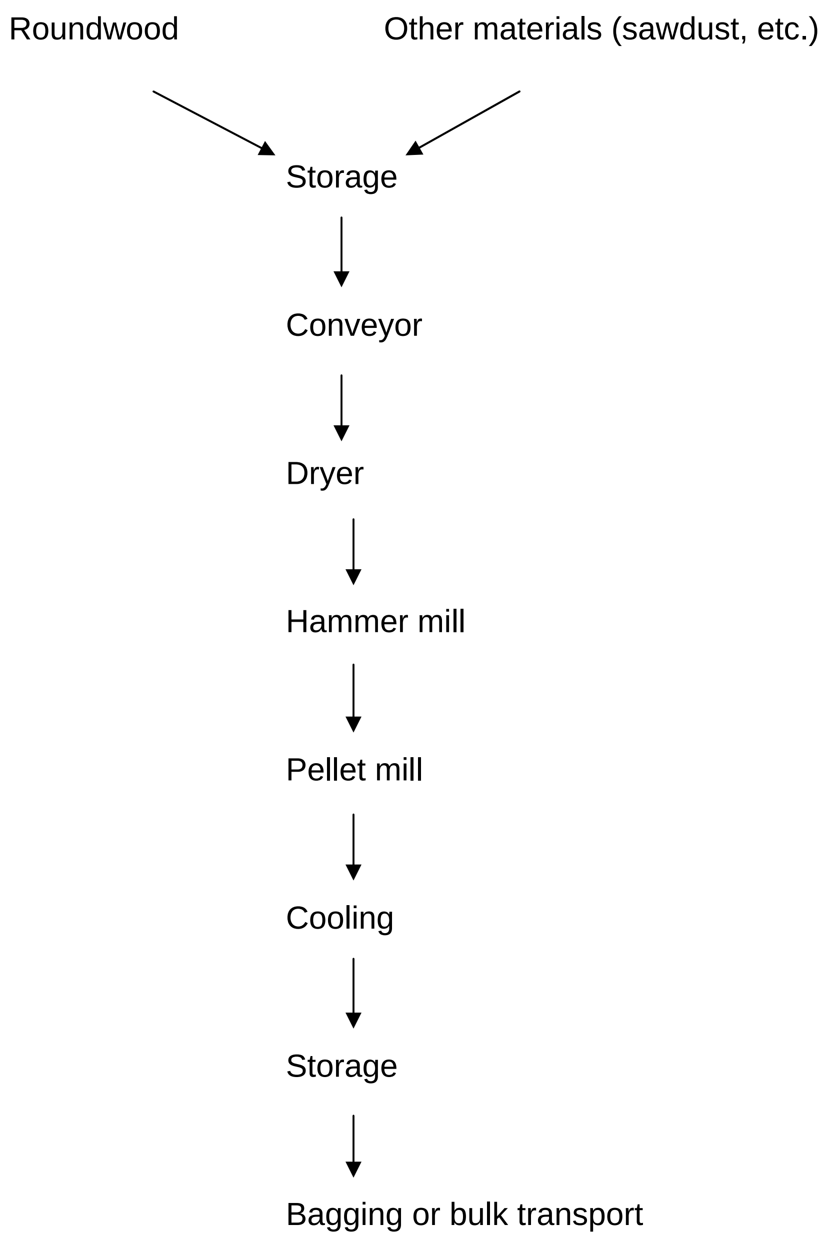
**Figure 7. Roundwood pile ready for debarking and chipping.**

At this point, clean green chips are ready to go to the pellet manufacturing process. They will be temporarily stored in covered bins and if alternative dry fuel is purchased (such as sawdust or other dry wood product waste from other manufacturing processes), mixed with this fuel onto the raw material **conveyor.** If excess clean chips are produced, these would also be available for shipment to pulp and paper mills as an alternative interim market. Bark from the de-barking process will be processed and sold to various markets as a by-product. While we are not necessarily recommending the use of combined heat and power, if the developer chooses to do so there may be opportunities to use the bark in that process, as well as to explore district heating in the West Burke village.

Note: This wood pellet facility will focus its raw material sourcing on roundwood supplies. If clean wood chip sources are located and deliver to the site, these materials would need to arrive in a live-bottom or self-dumping truck box since the facility will <u>not</u> include a chip box dumping equipment set.

**12. Manufacturing Process – Part II: Pellet Manufacturing**

**Figure 8.** General diagram of pellet manufacturing process.

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1. Logs are debarked and chipped – Logs will be debarked through a drum-debarker prior to on-site chipping. The result is a clean log devoid of any bark material.

2.  Log chipping – Debarked logs are then run through a chipper in order to produce clean chips. The material will be stored in covered bins on site for later moving into the pellet manufacturing building.  This process will occur outside, creating some noise.  However, the chipping area will be located behind the warehouse and pellet mill buildings, shielding residential areas from the potential noise impact.  As described above, debarking and chipping operations will also be confined to daylight hours for minimum disturbance.

3.  Loader moves chips to conveyor – Debarked chips (either from on-site debarking or received from other sources) and other material such as sawdust are loaded onto the conveyor system to enter the pellet mill facility for continued processing.  Material entering the facility will be anywhere from 20-60% moisture content.  Orientation  of the plant will be such that the noise from the back-up beeper on the loader will be minimized  - the buildings will block the noise from carrying into nearby populated areas (as with the noise from chipping and debarking).

**Figure 9.  Loader obtaining wood chip material from storage for conveyor loading into pellet mill.**      (Courtesy N.E. Wood Pellet)

4. Screening – The conveyor brings material to the screener and chips and larger material goes to the Hammer mill/grinder to reduce the material size.  Sawdust and other small diameter material of proper size move to drying.

5. Hammer mill/grinder for chips to reduce material size – larger material enters the Hammer mill/grinder to reduce the size of wood material entering the drying process. These processes will occur inside, leading to minimal noise impact on the surrounding area.

6. To storage bin or silo – Wood material that is of proper size for drying then enters a storage bin or silo from which material is drawn to enter the dryer. If various source material is purchased, such as green chips from the roundwood processing versus sawdust versus dried wood chips from furniture manufacturing cut-offs, the various silos will be able to be used in a "mixing" process to the dryer or to the final Hammer mill in order to obtain the correct and uniform moisture content desired for the pellet manufacturing process.

**Figure 10. Pre-manufacturing storage bin for wood raw materials.** (Courtesy N.E. Wood Pellet, Schuyler, NY)

7. Drying - Material from storage bins (and other sawdust or other material) are sent to the drum dryer. Heat to be provided by a biomass boiler fueled with sawdust and other material that has been processed by the Hammer mill/grinder.

**Figure 11. Dryer drum drying raw wood material.** (Courtesy N.E. Wood Pellet, Schuyler, NY)

8. Cyclones – Air is blown into cyclones from the dryer to further separate some moisture from the sawdust-like material produced in the Hammer mill/drying process. This and the drying process create noise, but the noise will be minimized by positioning the cyclones inside and towards the rear of the facility.

9. Fines separation - Sawdust is sent through a screener that separates coarse from fines. The coarse material goes through one final size reduction while the fines move on to the pellet machines.

10. Final Hammer mill - Coarse material goes through another Hammer mill/grinder to reduce the particle size. This Hammer mill is also located indoors.

**Figure 12. Screening and Hammer mill/grinder preparing wood for proper sizing.**
(Courtesy N.E. Wood Pellet, Schuyler, NY)

11. Storage of ready material - Ready sized/dried material is then sent to a silo for metering to pellet mills.

12. Pelletizing – Ready wood material is then metered from silo to the pellet mill/pellet extruder and pellets are made. There will be 3 pellet mills at the facility in order to produce the targeted output. With heat and pressure, the lignin within the wood becomes the binding agent so that the pellets keep their shape once the pelletizing process is complete. Noise impact to the surrounding area from this process will be alleviated by the indoor location of the pellet mills.


**Figure 13. Pellet machines.** (Courtesy N.E. Wood Pellet)

13. Pellet cooler – Once the pellets are produced, they travel to a cooling system to reduce their temperature for storage and bagging. Finished pellets will be between 4-8% moisture content.

14. Finish pellet silo – Finished pellets travel to a large silo for storage and later metering for bagging or bulk delivery.

15. Bagging – While bulk delivery customers of pellet material will be sought, initially most product will be bagged in the automated bagging system.  40 pounds of pellets will be loaded into plastic bags by a robot.  These bags will be placed onto pallets, making 1 ton pallets (50 bags). Plastic wrap will hold the bagged materials onto the pallet.


**Figure 14.  Robotic pellet bagging operation.** (Courtesy N.E. Wood Pellet)

16. Fork lift – A fork lift will transport the completed 1 ton pallets of pellets to the warehouse for later shipping.

**Figure 15. Pellet warehousing on one-ton pallets**. (Courtesy N.E. Wood Pellet)

17. Shipping – Most product will be shipped on flat bed trucks to various retail and wholesale markets. Some pellets may be metered into 5-ton bulk delivery trucks for delivery to sites and markets requiring bulk deliveries to on-site silos.

## 12.2. Noise, Traffic, Dust, Vibration and Aesthetics

In the course of the processes described above, noise, dust and vibration are created. Noise impacts on the surrounding communities will be reduced as already outlined, through careful orientation of the site – most of the equipment will be placed inside, and what cannot be inside (loaders, the chipper, and the debarker) will be located behind the facility buildings to block sound travel. Information on the exact decibel levels created with wood pellet manufacturing equipment is not available, but an average factory or woodworking shop ranges from about 90 to 100 decibels inside the facility. The federal Occupational Safety and Health Administration (OSHA), which provides guidelines on maximum exposure levels to sound, requires that hearing protection be worn at those decibel levels. The insulated walls of the facility, however, will decrease sound exposure to almost normal levels (45 to 50 decibels) outside the building. The chipper and debarker will probably produce sound of between 100 and 120 decibels, but this activity will occur behind the mill buildings, using them as barriers, and only during daylight hours. Sound levels at the closest residences to the facility are expected to be less than 40 decibels during full operation.

Outdoor dust will be created by debarking, chipping and truck traffic, but at levels low enough to remain contained on-site. Other machinery that creates dust will be located inside the building. Vibration from indoor equipment will probably occur, but not at levels high enough to be felt outside the manufacturing area as evidenced at other operating facilities experienced by the INRS team during the research for this project.

Increased truck traffic to and from the site will lead to an increase in dust, vibration, and noise in the surrounding community. This can be partially alleviated by requiring that the trucks utilize specific access routes that avoid the most highly populated areas. There is, however, one access road into the site that goes through a residential neighborhood and that cannot be avoided. Also, truck traffic noise levels that will be experienced are below any requirements for noise exposure set by OSHA. OSHA maximum exposure level restrictions begin at 85 decibels for less than 16 hours exposure per day, and the sound level of truck diesel engine is about 70 decibels at safe distances from traveling vehicles. The OSHA rule of thumb for determining high noise levels is that if you cannot hold a conversation in a normal speaking voice with a person who is standing at arm's length (approximately 3 feet), the noise level may exceed 90 decibels.

It is estimated that there will be approximately 100-200 trucks of raw material headed into the plant per week, and approximately 100 trucks of finished product leaving the plant per week.

Local aesthetics will most likely not be affected by mill activity. The highest structures that will be constructed are pellet storage silos, usually from 35 to 45 feet tall.

## 13. Output Markets

There will be two key markets for wood pellet materials produced at the Sutton pellet mill. First, bagged pellets for the residential market will be the main focus of production output. Second, bulk deliveries to commercial and residential markets will be a growing secondary market for the production from this facility.

### 13.1. Pellet quality standards

The Pellet Fuels Institute (PFI) has developed a voluntary pellet fuel grading system that all pellet manufacturers must follow if they wish to label their product according to grade (and all manufacturers do this). This is the standard for the industry. Table 2 describes the standards being followed for the four pellet grades: Super Premium, Premium, Standard and Utility.

**Table 6. Pellet Fuels Institute pellet fuel standard.**

| Fuel Property | Residential/Commercial Densified Fuel Standards - See Notes 1 - 9 | | | |
|---|---|---|---|---|
| | PFI Super Premium | PFI Premium | PFI Standard | PFI Utility |
| Bulk Density, lb./cubic foot | 40.0 - 46.0 | 40.0 - 46.0 | 38.0 - 46.0 | 38.0 - 46.0 |
| Diameter, inches | 0.250 - 0.285 | 0.250 - 0.285 | 0.250 - 0.285 | 0.250 - 0.285 |
| Diameter, mm | 6.35 - 7.25 | 6.35 - 7.25 | 6.35 - 7.25 | 6.35 - 7.25 |
| Pellet Durability Index | ≥ 97.5 | ≥ 97.5 | ≥ 95.0 | ≥ 95.0 |
| Fines, % (at the mill gate) | ≤ 0.50 | ≤ 0.50 | ≤ 0.50 | ≤ 0.50 |
| Inorganic Ash, % - See Note 1 | ≤ 0.50 | ≤ 1.0 | ≤ 2.0 | ≤ 6.0 |
| Length, % greater than 1.50 inches | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 |
| Moisture, % | ≤ 6.0 | ≤ 8.0 | ≤ 8.0 | ≤ 10.0 |
| Chloride, ppm | ≤ 300 | ≤ 300 | ≤ 300 | ≤ 300 |
| Ash Fusion - See Note 8 | NA | NA | NA | NA |
| Heating Value - See Note 1 | As-Rec. ± 2SD | As-Rec. ± 2SD | As-Rec. ± 2SD | As-Rec. ± 2SD |

Source: Pellet Fuels Institute 2009

The one major difference among the four pellet grades noted by the PFI grade table is ash content. As the grade of pellet goes from Super Premium to Utility, the ash content allowed increases from less than or equal to 0.5% (by weight) to less than or equal to 6.0%. Minor additional allowances for moisture content also occur from Super premium (6%) to Utility (10%) grades.

Pellet manufacturers generally list the grade of their pellet products and, if they meet the standard described (there are a number testing labs qualified to test the pellets to determine grade) then they are allowed to use the PFI grade stamp on the product packaging.

### 13.2. Pellet demand

Given the direction of fossil fuel pricing and most particularly heating oil for home heating, wood pellets are an attractive alternative to home heating oil, natural gas or propane. Table 7 shows these comparisons putting wood pellets, on a BTU cost basis, on par with or less expensive than heating oil or propane. While no study has been done to determine the likelihood of residential consumers to switch to pellets at these prices, historical conversions to pellets have already occurred.

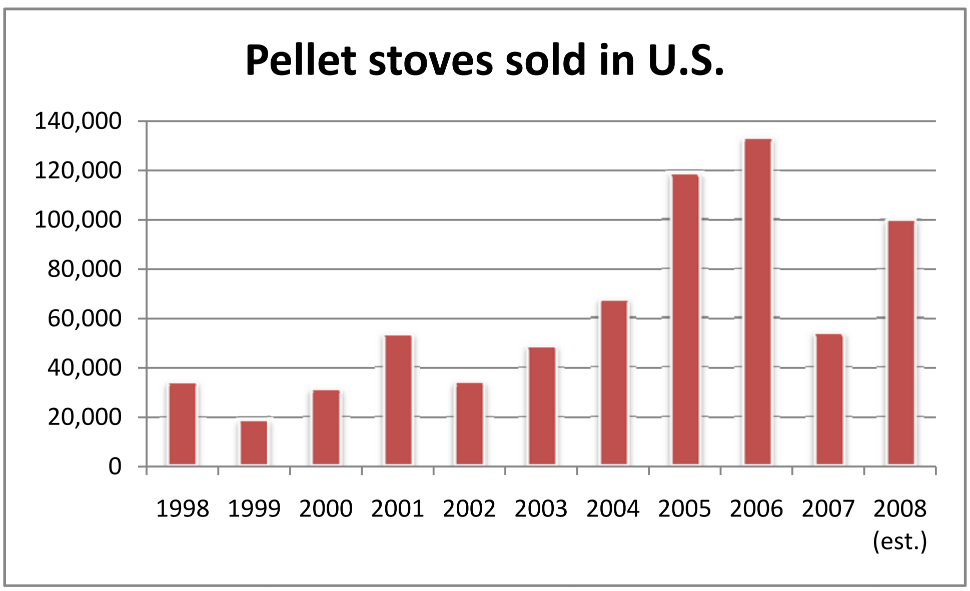
**Table 7. Comparison Chart - Wood Pellet to other heating fuel costs, New England (reported in dollars per ton, gallon, cord, or million BTU).**

| Fuel Type | 2009 | | 2010 | |
|---|---|---|---|---|
| **Wood pellets** | ($290/ton) | $22.10/mbtu | ($300/ton) | $22.87/mbtu |
| **Fuel oil** | ($2.40/gal.) | $23.30/mbtu | ($2.50/gal.) | $23.23/mbtu |
| **Propane** | ($2.96/gal.) | $41.55/mbtu | ($3.25/gal.) | $45.67/mbtu |
| **Firewood** | ($250/cord) | $20.83/mbtu | ($290/cord) | $24.17/mbtu |

Sources: Pellet Fuels Institute, Energy Information Administration, local data from sales

In the near term (in the next 3 years) it is expected that most of the growth in the wood pellet market will be in the pellet stove, boiler, furnace and central heating system area. The individual stoves, substitutes for chunk-wood (firewood) stoves, are selling in New England and the U.S. market at unprecedented rates. Wood pellet stove sales have already increased from 34,000 in 1998 to more than 67,400 in 2004, and over 130,000 in 2006 according to the Hearth, Patio & Barbecue Association. A drop in 2007 was followed by an increase in 2008 not yet fully tabulated according to industry sources but estimated to be in the 100,000 stove range.

**Figure 16.**




Source: Hearth, Patio & Barbecue Association

The larger long-term market for wood pellets will be home and small business wood pellet boilers to replace or run in tandem with oil and gas-fired boilers now dominating the home-heating market in the region. Currently the drawback is that there are very few boiler manufacturers. This is changing rapidly. Unfortunately, no local pellet and pellet heating system demand data is available to provide more specific analyses.

A federal tax credit on stoves went into effect January 1, 2009, providing a 1 year incentive. According to the Hearth, Patio & Barbecue Association and Pellet Fuels Institute:

Included in the 2009 Economic Stimulus legislation signed into law by President Obama on February 17, 2009, is a 30% (up to $1,500) consumer tax credit in 2009 and 2010 for the purchase of a 75% efficient biomass-burning stove as measured using a lower heating value. Pellet Fuels Institute (PFI) and the Hearth, Patio & Barbecue Association (HPBA) succeeded in improving the tax credit to promote renewable energy and help consumers fight rising home heating costs.

The tax credit provisions in this new legislation contain improvement amendments to the legislation passed in October 2008. The major changes made were an extension of the credit to 2010 and an increase of the credit from $300 to 30% of the total cost.

Pertinent language in the legislation can be found in Appendix B.

This tax credit will undoubtedly increase stove and boiler sales in 2009 and increase demand for wood pellets in the United States substantially.

Currently, 80 pellet mills exist in North America producing just over 1.4 million tons of wood pellets per year with a theoretical capacity of over 2 million tons. With current demand, that entire production is being sold. Between 90-95% of this production is of the higher quality wood pellets destined for residential pellet markets for use as a fuel for heating homes and other structures. Projections for the near future are for worldwide production to go from 9 million tons in 2008 to over 15 million tons in 2010 (Austrian Pellet Industry Association). European demand may top 150 million tons by 2020 according to industry sources.

U.S. demand has been steadily increasing and is expected to continue increasing at 10-20% per year into the foreseeable future, very dependent on fossil fuel prices for thermal applications[8].

### 13.3 Pellet pricing

Wood pellet pricing at the wholesale and retail level has increased over the last five years. In 2005, wholesale prices ranged from $140-170/ton in the northeast region. Retail prices during that period ranged from $220-240 ton. In the northeastern U.S., today wholesale prices range from $170-220/ton according to industry sources and retail prices are between $280-340/ton in forty-pound plastic bags.

Bulk deliveries still make up far less than 1% of deliveries in the U.S. and these prices range from $190-230/ton delivered. While bulk market expansion has occurred in Europe in a significant way, it is not clear how long this conversion from bags to bulk will take in the U.S. without government subsidies.

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[8] Personal communication, New England Wood Pellet personnel

As with any growing industry, particularly one so dependent on fossil fuel prices, prices at the wholesale and retail level during 2009 to 2011 period when the Sutton plant would be constructed, may be quite different. Futures markets for these pellet fuels do not yet exist.

### 13.4 Exporting

While demand for wood pellets has increased dramatically in recent years in the United States, demand from within Western Europe has increased even more. There are currently 518 wood pellet manufacturing plants in Europe (Bioenergy International, 2009), up from just over 400 plants in 2006. Growth there is expected to continue exponentially. Despite this rapid expansion of plants and production, demand still has out-stripped supplies in recent years and export to Europe is a real option for some U.S. facilities. Several larger pellet production facilities in the southern U.S. have already been shipping to these markets.

European use of pellets is very different from that in the U.S. It is estimated by the Pellet Fuels Institute that over 99% of wood pellet consumption in the U.S. is in space heating stoves. In Europe, the majority of wood pellet use is in central heating furnaces and boilers. While a significant number of stand-alone space heating stoves still exist, the transition to central thermal applications is well underway. Additionally, significant electricity is generated using wood pellets as fuel and commercial and even industrial use of pellets as fuel for heating and steam production is commonplace and rapidly increasing.


**Figure 17. Pellet manufacturing facilities in Europe 2007.** Source: Bioenergy International

## 13.5 Rail connection at the site

The rail line and associated siding at the Sutton site are owned by the Washington County Railroad Company – Connecticut River Division (primary contact: David Wulfson, President, 802-658-2550). The opportunity to use the rail siding may help decrease costs if the bulk pellet market develops over time. Also, though less desirable, it may be possible to access the European markets through bulk pellet shipments via rail through Maine ports. Since bulk markets are currently rare in the Northeastern U.S., the developer of a pellet mill at the Sutton site will need to be active in developing or gaining access to any bulk markets that may occur in the U.S. to fully take advantage of the rail siding. Another possibility, though virtually untried, is the shipping of bagged skidded pellets on flat rail cars to more concentrated pellet retailers in the Northeastern U.S. or nearby. The economics of this are not yet developed.

## 13.6 Non-market support

While non-market support of pellet manufacturing and use has been significant in Europe, where we have seen an explosion of growth in both production and use in the last decade, government has done very little to encourage this industry in the U.S. In Europe a carbon tax in many countries immediately resulted in discrimination against the use of fossil fuels for thermal applications. These changes were enacted in the last decade in large part over interest in reducing carbon emissions as a result of adoption of the Kyoto Protocol.

In the U.S., federal legislation on the carbon issue is likely to pass under the new Congress and the Obama administration. This will likely benefit the production and use of wood pellets for thermal applications. At the state level, over 30 Renewable Portfolio Standards are in law yet none of them directly encourage use of biomass like pellets for thermal applications because these laws are all designed to encourage renewables for electricity production, not thermal.

Despite this, two recent federal policies have shown support. The 2005 federal Energy Bill included a provision for a rebate program that would have provided a federal rebate if wood pellet boilers or stoves were purchases by a consumer. This program was authorized in the bill but never funded so the incentive never materialized. The $300 tax credit in the Emergency Economic Stabilization Act of 2008, more fully described above, is a real, though small, incentive for the calendar year 2009. Details of qualifying wood pellet burning units and other requirements have yet to be released by the IRS or Treasury Department.

Other incentives for potentially carbon neutral thermal devices like wood pellet burning stoves, boilers or furnaces can be expected in the next few years. These unknown policies will likely benefit any pellet plant built on the Sutton site but in, as yet, unknown ways.

# 14. Competition

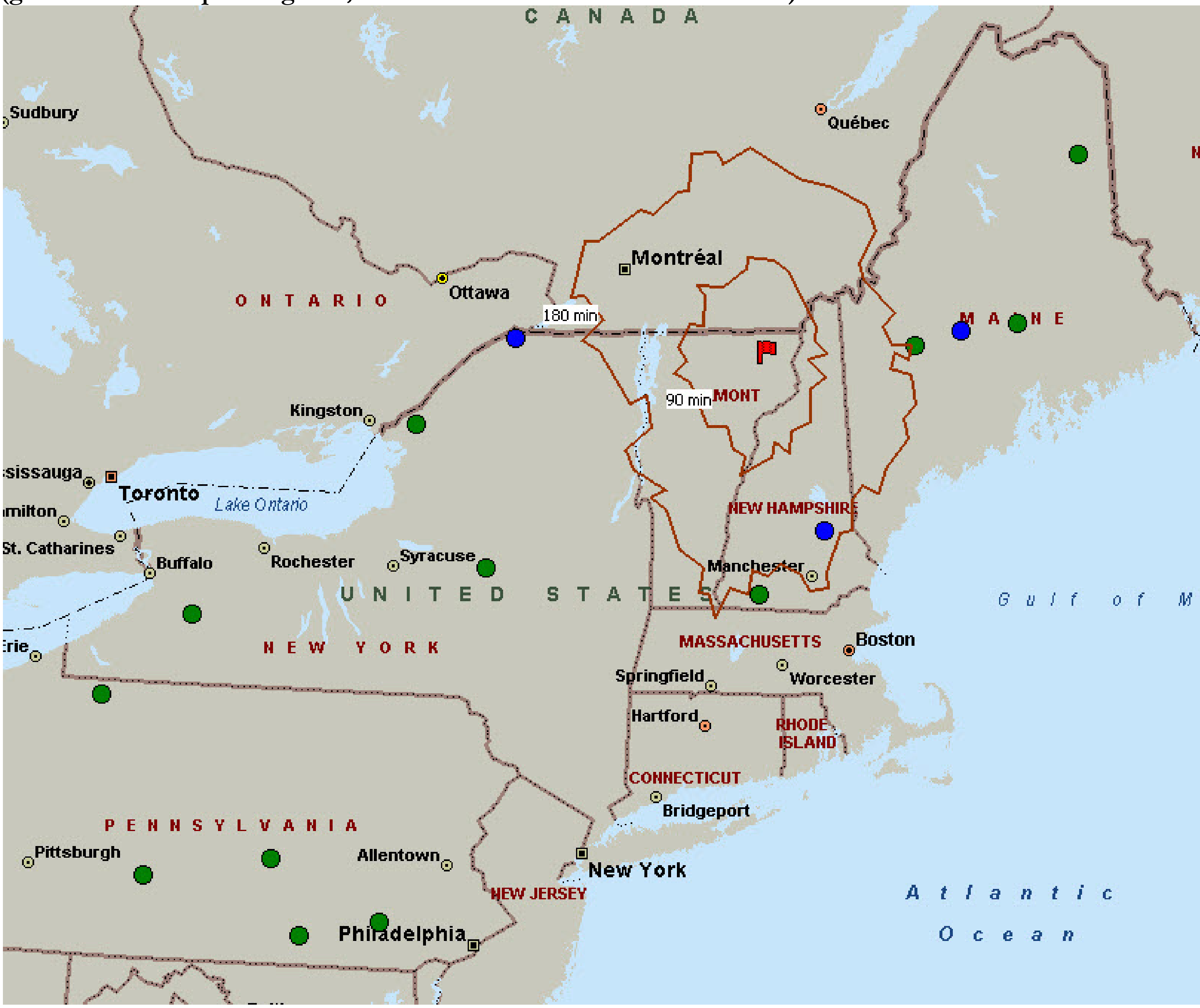
There are at least 80 wood pellet manufacturing facilities in North America as of this writing. Of these, thirteen plants are operating in Canada, many of which can be considered competing producers, as well as those in the U.S. Northeastern US plant locations can be seen in Figure 18.

While these are not the only direct competing facilities to a plant built on the Sutton site, these are the likeliest unless the Sutton plant takes full advantage of the rail siding to access markets more distant than the traditional 60-100 mile radius of customers that many of the Northeastern plants have for their customer base. Bag product customers of the pellet manufacturers tend to be the stove retail shops and garden supply retail establishments. A few stand-alone pellet sales only companies exist in the U.S. as well. An example of this kind of customer is PelletSales.com a rapidly expanding wood pellet distributor with headquarters in Goffstown, NH and distribution zones in many areas of the country.

Once the pellet manufacturing facility is up and running, the major output product for the facility will be wood pellets sold to wholesale and retail markets. The projected 100,000 ton annual production will be fulfilling market needs in the sales region which is anticipated to be at least the northeastern United States.

As with any commodity product such as wood pellets, all the producers in North America are potentially competitors to a facility built at the Sutton site. An advantage of this site is that most wholesale customers of bagged wood pellets tend to be within 60-100 miles of the existing pellet producing facilities in the northeast. The nearest production facility currently is well over 100 miles from the Sutton site. With increasing demand and the location of production facilities, the Sutton mill should be able to develop market share close to the facility, reducing transportation costs. The Upper Valley region of Vermont and New Hampshire is an affluent area close by that will provide a jumpstart to markets for the facility.

**Figure 18. Wood Pellet Mills in Northeastern U.S with 90 and 180 minute drive-time circles (green indicates operating mill, blue indicates mill under construction).**




Current wood pellet producers in Northeast U.S. are found in Table 8.

**Table 8. North East US Pellet mills.**

| Company | Location |
|---|---|
| Planned/under construction | Massena, NY |
| Allegheny Pellet Corp. | Youngsville, PA |
| American Wood Fibers | Columbia, MD |
| Associated Harvest Co. | Lafargeville, NY |
| Dry Creek Products, Inc. | Arcade, NY |
| Energex Pellet Fuel, Inc. | Mifflintown, PA |
| Hamer Pellet Fuel Co. | Kenova, WV |
| Ironstone Mills, Inc. | Leola, PA |
| Lignetics of West Virginia | Glenville, WV |
| New England Wood Pellet, Inc. | Jaffrey, NH |
| Penn Wood Products, Inc. | East Berlin, PA |
| Wood Pellets Co. | Summerhill, PA |
| New England Wood Pellet, Inc. | Schuyler, NY |
| Corinth Wood Pellets | Corinth, ME |
| Maine Woods Pellet | Athens, ME |
| Geneva Energy | Stong, ME |
| Planned – Lakes Region Pellet | Barnstead, NH |

## 15. Management and Staffing

Some description of staffing levels was included earlier in this report, but a more thorough staffing overview can be found in this section.

Approximate staffing structure – wood pellet manufacturing facility:

1. Scale house person

2. Debarker operator

3. Chipper operator (may be the same person as debarker operator or yard loader operator)

4. Yard loader operator

5. Pellet mill manager

6. Sales persons (2)

7. Mill workers (4-5 per shift – total 10-12 workers)

8. Shift supervisors (2)

8. Warehouse/shipping persons (2)

9. Office manager/secretary

Total number of employees – 24

## 16. Location, Site and Permitting

The Sutton site has approximately 21.6 acres of usable space for the pellet mill operation. The mill and related operations will need only approximately 10 acres for its core activities plus additional acreage for mud season wood purchases. The site currently has a wood concentration business owned by the Dillon Logging Company and there is enough room on the site to allow that to continue as a leased operation. Doing so might provide a better base for wood purchasing since many wood suppliers already use the site for wood deliveries.

The Sutton site is currently used by logging trucks accessing the wood concentration yard on the site. As such, it has adequate road and entrance-way access. The immediate access road (Mill Road) enters from Depot Street in West Burke. Depot Street accesses Vermont Route 5. Mill Road travels through a residential neighborhood, but the Burke mill used to have many trucks accessing the site and the current wood yard operation has similar truck traffic.

**Figure 19. General location of Sutton, Vermont site.**

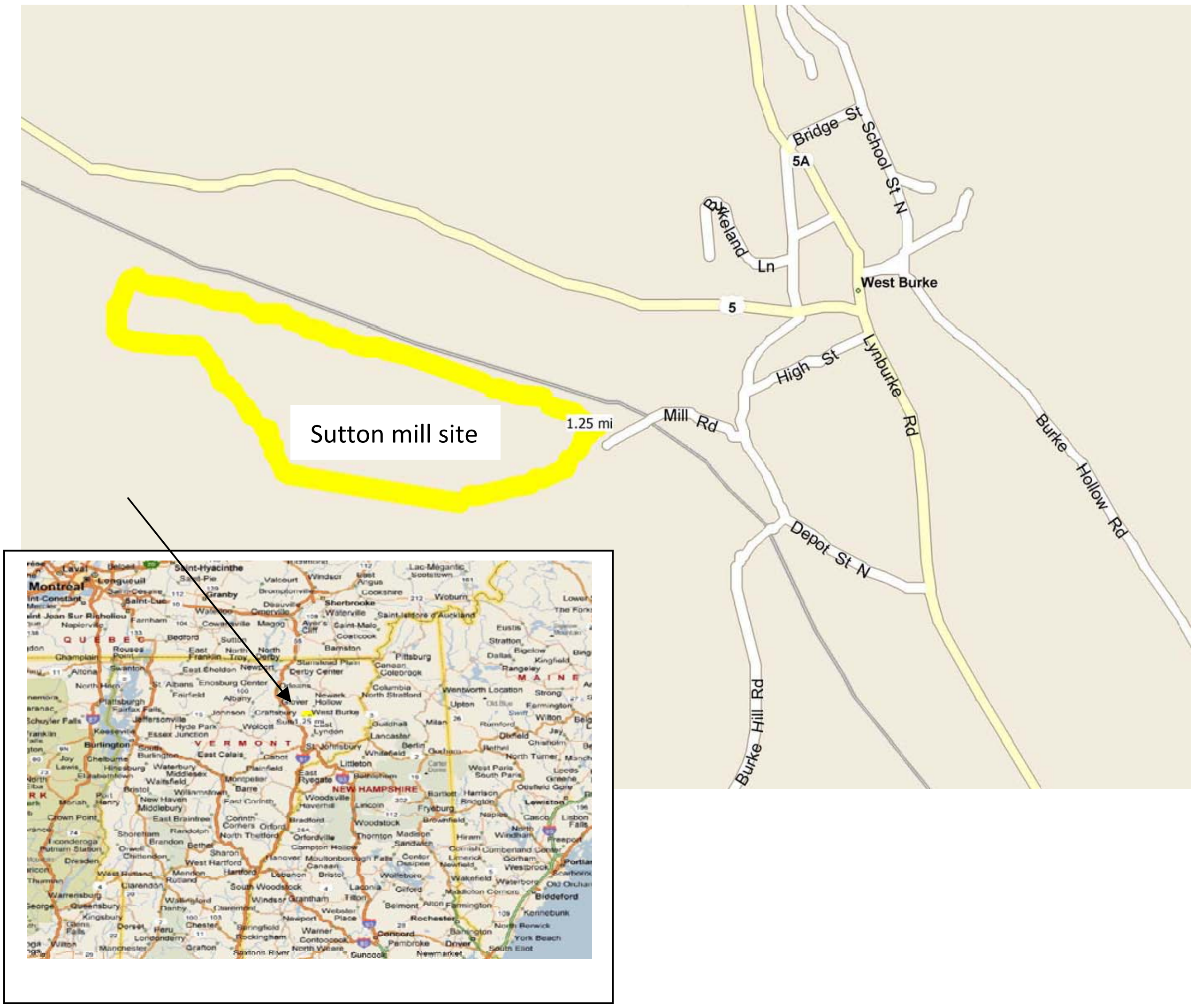
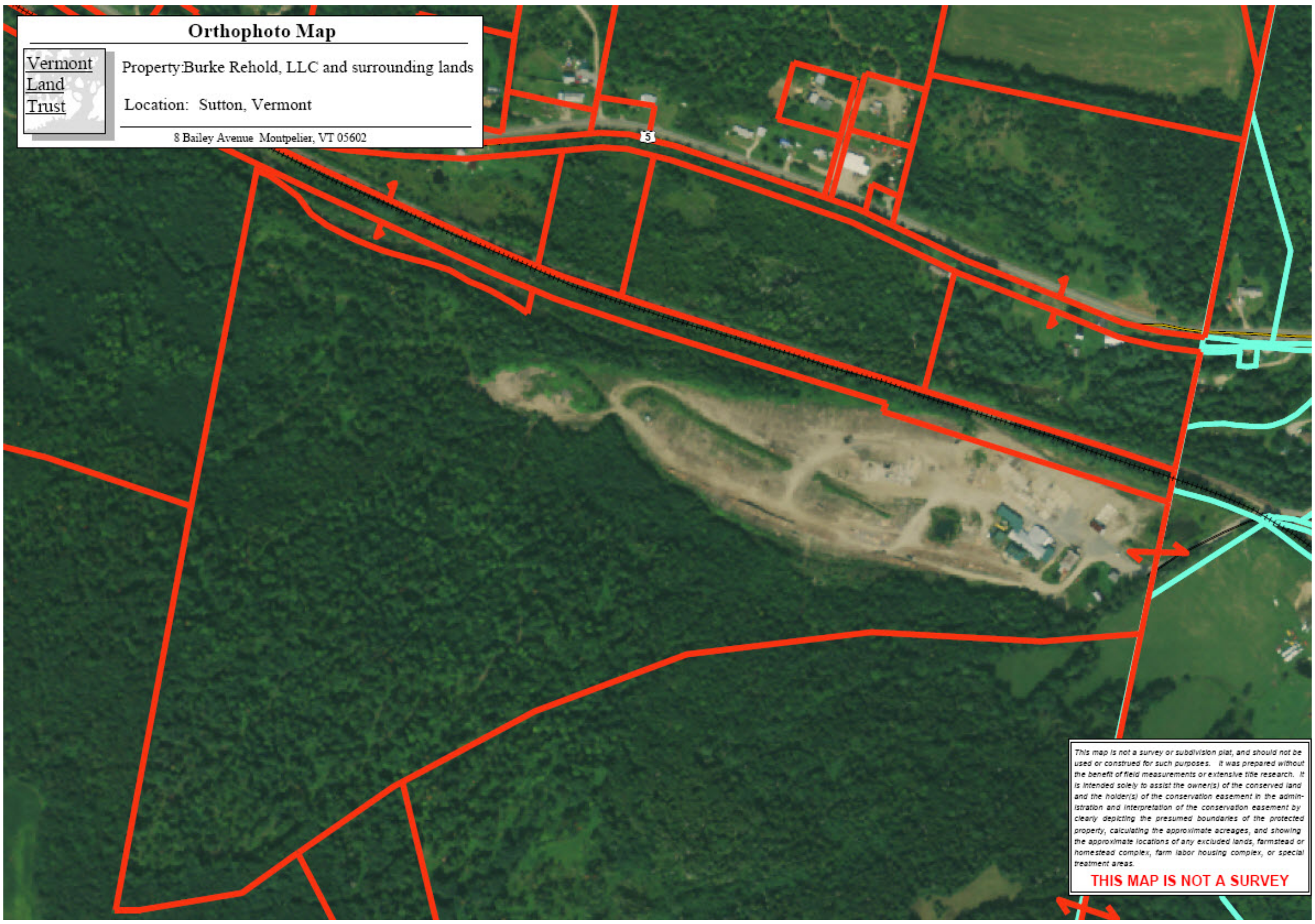


**Figure 20. Sutton, Vermont Orthophoto Map showing property boundaries [source: Vermont Land Trust].**




Access road weight limitations, posted as 24,000 pounds on the Mill Road access road, are commonplace for town roads in Vermont. The Burke selectboard have been queried about the issue by Paul Brouha, chair of the Sutton mill site Committee. The Town of Burke has given, as they are authorized to do, an overweight permit for the current wood yard operations on the site. The owner has paid a $2500 bond for this purpose. This was also the situation when the Burke Mill was operating[9].

A suggested layout for the wood pellet mill operation is shown in the following diagram. This is one

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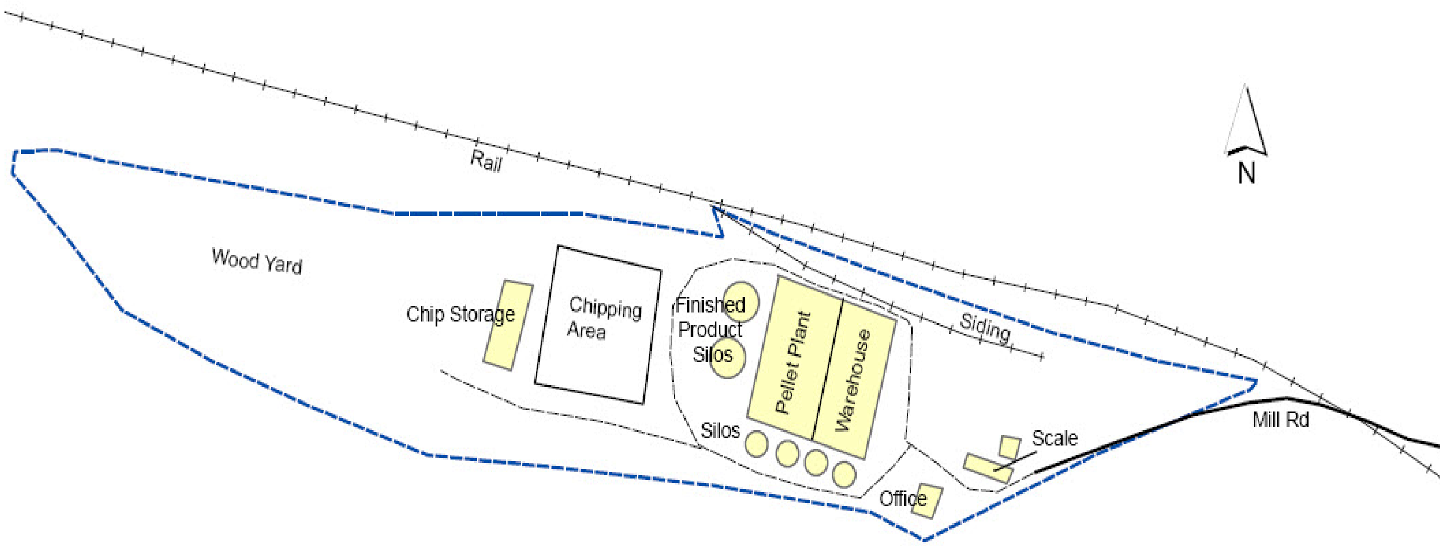
[9] Chapter 13: Operation of Vehicles of Title 23: Motor Vehicles of the Vermont Statutes governs these issues. Essentially, municipalities control weight limits on all Class II and III highways (like the Mill Road).

of many similar configurations possible for the operation.  The existing truck scale and office at the entrance to the site can continue to serve those purposes.  Chip storage (covered) bins, numerous silos for both raw material and finished pellet material, and the main pellet plant and warehouse facility will all be necessary structures.  The site will also contain the wood yard and debarking/chipping area.  A loop road will travel around the main pellet plant building.

**Figure 21. Possible wood pellet mill layout – Sutton, Vermont site** (blue dotted line indicates open flat area).

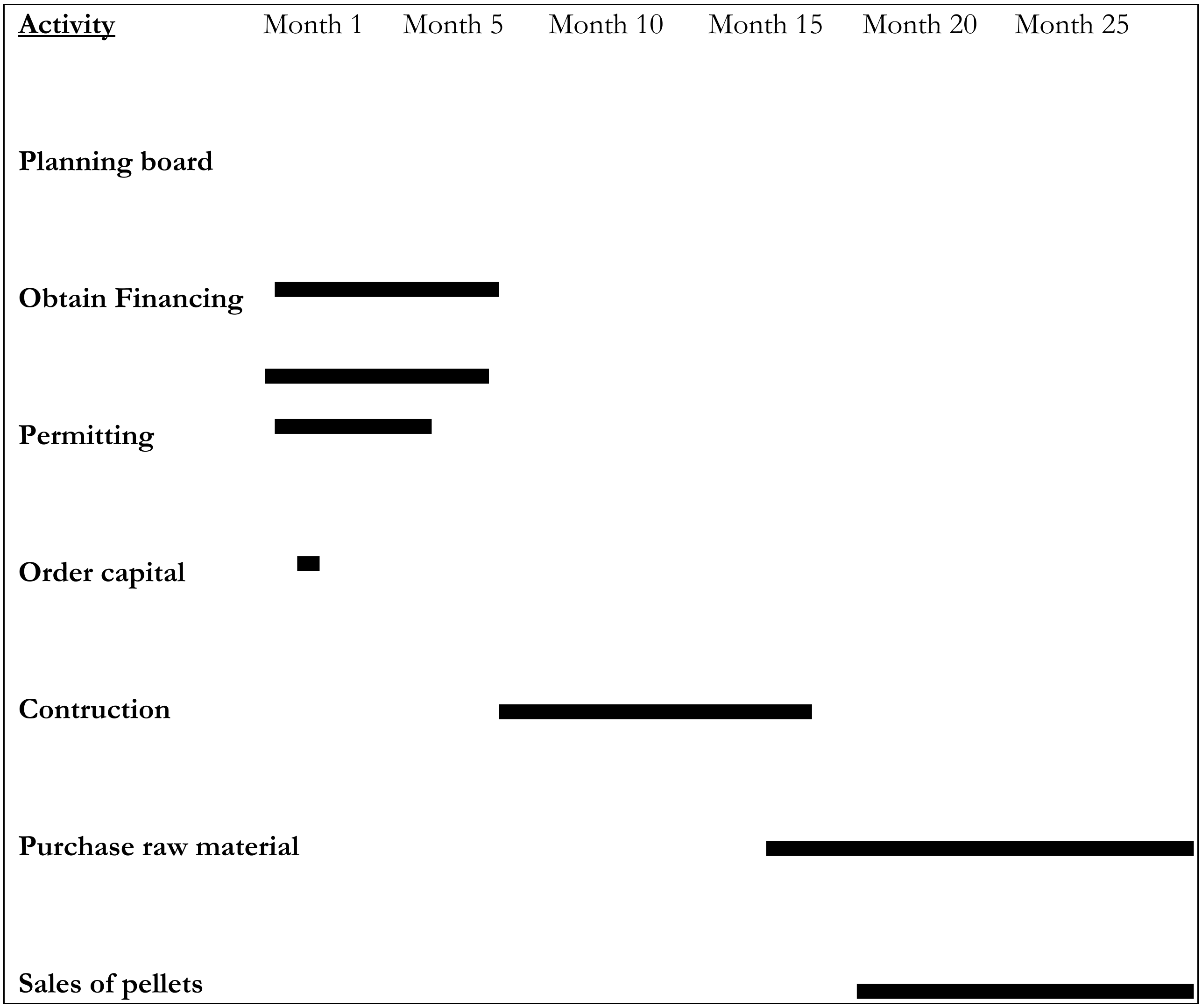


### 16.1. Local Permitting and Act 250

The site is classified as part of the Rural District in the town of Sutton. As such, before any new construction can occur, a development plan will have to be approved by the town Planning Commission. This plan must include a map and written narrative, and include the locations of proposed structures, land use areas, roads and driveways, parking areas, landscaping plans, lighting plans and location and size of any signs. Building permits for new structures and renovations will also be required. Act 250, the Land Use and Development Act, is a law unique to Vermont which reviews development projects prior to their approval, with the intention of protecting the state's environment, community life and aesthetic character. The Sutton site is already in possession of an Act 250 permit, #7C0173, approved for construction of the first sawmill and road on the site in 1973. That permit has been amended 19 times over the years, as new structures and additions to existing structures have been added. The most recent amendment, approved in 1997, addressed the construction of the rail spur. This amendment process will need to occur for each new structure and road necessary for the construction of a pellet mill, as well as any additions to current structures. Other permits that may be required, according to Vermont Department of Environmental Conservation Permit Specialist John Miller (802-476-0195) include the following:

- Air quality permit for the chip dryers (state contact: Doug Elliot, 802-241-3845)
- Discharge permit for drains on site that lead directly to the Sutton River (state contact: Randy Bean, 802-241-3825)
- Public water supply permit – a registered public water supply (#VT0020353) exists on the site (state contact: Jim Siriano, 802-241-1410)
- Stormwater runoff permit – a permit is already registered for the site (#5976-9010), but it may need to be updated (state contact: Dan Mason, 802-241-3679)
- Multi-sector general permit (state contact: Christy Witters, 802-241-4582)
- Wastewater permit – a permit exists for the site (#WW-7-0280), but most of the associated buildings have been removed and a new permit may be required (state contact: Steve Rebillard (802-751-0458).

**Figure 22. Development Timeline.**



## 17. Financials

| |
|---|
| The financial modeling completed for the proposed wood pellet facility shows a Return on Investment[10] of about 279%. The bottom line is that, given the assumptions in this business plan, building a wood pellet plant at the site is a good investment and should be pursued. |

**17.1. Capital Costs** – Equipment manufacturers have quoted equipment in "package" formats and the list below reflects that. This list is for the equipment including construction costs. It is important to note that two very recently constructed wood plants in the northeast region are known to have similar costs for capital and construction.

**Capital Budget**
100,000 ton pellet manufacturing facility (~13 tons per hour)

| | | |
|---|---|---|
| Land, Buildings, Site Preparation (including demolition of existing buildings) | $ | 2,600,000 |
| Truck Scale | $ | 90,000 |
| Drum Debarker | $ | 200,000 |
| Green Material Storage, Infeed and Processing | $ | 270,000 |
| Green Hammermill, including conveyors and air relief | $ | 250,000 |
| Wood Dryer and Discharge System | $ | 2,000,000 |
| Dry Hammermill, including conveyors and air relief | $ | 360,000 |
| Spark Detection and Extinguishing Equipment | $ | 100,000 |
| Finished Raw Material Storage and Liquid Additive | $ | 1,000,000 |
| Pellet Mill | $ | 800,000 |
| Pellet Discharge and Cooler | $ | 200,000 |
| Finished Product Handling and Storage | $ | 130,000 |
| Bagging Equipment and Pallet Wrapper | $ | 500,000 |
| Systems Control, Engineering and Layout | $ | 900,000 |
| Miscellaneous | $ | 600,000 |
| | $ | 10,000,000 |

**17.2. *Pro forma* Balance Sheet Notes**

---

[10] Return on Investment (ROI) - A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments.

$$\text{ROI} = \frac{(\text{Gain from Investment} - \text{Cost of Investment})}{\text{Cost of Investment}}$$

The following *pro forma* financials for the proposed wood pellet plant are constructed using key assumptions listed below. In addition to these stipulations, the *pro forma* assumes 10-year debt service for the capital construction on the facility and it also assumes an upfront cash cushion to purchase raw material for a period of 3 months prior to when income from sale of pellets is expected. Other specific assumptions and stipulations are:

1. This *pro forma* assumes a "bag and sell" business model, where all product is bagged and sold to distributors, retailers or end consumers.
    a. This is notably different than other existing business models, which include but are not limited to: sale of metered heat, bulk sales, and sale to export markets (bulk).
2. This *pro forma* assumes that there is no revenue from anything except pellet sales.
    a. No revenue from sale of carbon credits or offsets
    b. No revenue from thermal Renewable Energy Certificates or other incentives
    c. No demand response payments for electricity management
3. Assumes that roundwood purchases are double the pellet sales volume
    a. Average moisture content of 45%
    b. The excess is bark, which is removed by the debarker and burned in the dryer as part of the manufacturing process
4. Assumes 24 laborers at an average of $35,000
    a. This is higher than would be expected in this geographical labor market, and would not necessarily be seen if a commercial facility were to open in Burke.
    b. Assumption that benefits, taxes, etc. add 40% to the wages
5. Electricity
    a. Assumes 1.5 MW of electricity use, 90% of the time (7884 hours per year, the rest is downtime)
    b. 1.5 MW is based upon electricity use at several existing pellet mills of this size
    c. Assumes $180 per MWH (18 cents per kwh)
        i. According to USDOE Energy Information Agency, average in VT (all customers) is $120 MWH
        ii. This is 150% of current market price
        iii. Premium meant to capture cost associated with no 3-phase power on site, which can be handled one of 2 ways:
            1. Pay for grid connection
            2. Pay for on-site generation
6. Debt service at 8%, later table shows other percentages.
    a. (80% debt, 20% equity assumed)
7. Sinking fund is a monthly payment to self for future capital needs / capital replacement. Meant to be "money in the bank" when something is needed.
    a. $500,000 per year for 20 years represents $10 million (no interest), cost in today's dollars for a new plant.

Additional information on annual capital costs and ROI sensitivities (to pellet and roundwood price) is available in Appendices C, D, E and F below.

## 17.3. *Pro Forma* Income Statement

| | Dollars | Percent of Revenues |
|---|---|---|
| **REVENUES** | | |
| Wood Pellet Sales | $20,000,000 | 100.0% |
| Other (Tax Credits, Carbon Offsets, etc.) | $0 | 0.0% |
| ***Total*** | ***$20,000,000*** | ***100.0%*** |
| **COST OF GOODS SOLD** | | |
| Roundwood | $9,900,000 | 49.5% |
| Bags | $800,000 | 4.0% |
| Pallets | $500,000 | 2.5% |
| Shrink Wrap | $85,000 | 0.4% |
| | | |
| Operating Labor (wages) | $840,000 | 4.2% |
| Operating Labor (benefits and associated) | $336,000 | 1.7% |
| | | |
| Laboratory & Testing | $25,000 | 0.1% |
| | | |
| Electricity | $2,128,680 | 10.6% |
| System repair | $200,000 | 1.0% |
| Water & Sewer | $5,000 | 0.0% |
| | | |
| ***Total Cost of Goods Sold*** | ***$14,819,680*** | ***74.1%*** |
| | | |
| **GROSS PROFIT** | **$5,180,320** | **25.9%** |
| | | |
| **EXPENSES** | | |
| Debt Service (10 years @ 8%) | $1,164,744 | 5.8% |
| Sinking Fund | $500,000 | 2.5% |
| Management (loaded) | $252,000 | 1.3% |
| Office Labor (loaded) | $126,000 | 0.6% |
| Insurance | $120,000 | 0.6% |
| ***Total Expenses*** | ***$2,162,744*** | ***10.8%*** |
| | | |
| **PROFIT BEFORE INTEREST AND TAXES** | **$3,017,576** | **15.1%** |

**Assumptions**

| | |
|---|---|
| Annual Production (dry tons) | 100,000 |
| Price of Wood Pellets ($ / ton) | $200.00 |
| Roundwood ($ / green ton) | $50.00 |
| Bags ($ / packaged ton) | $8.00 |
| Pallets ($ / packaged ton) | $5.00 |
| Shrink Wrap ($ / packaged ton) | $0.85 |
| Electricity ($/MW) | $180.00 |

## 17.4. *Pro Forma* Cash Flow Statement

| | Pre-Startup | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|---|
| **1. CASH ON HAND** | | | | | |
| [Beginning of month] | 100,000 | (1,150,000) | 1,867,576 | 5,002,210 | 8,256,828 |
| **2. CASH RECEIPTS** | | | | | |
| (a) Cash Sales | | 20,000,000 | 20,500,000 | 21,012,500 | 21,537,813 |
| (b) Collections from Credit Accounts | | 0 | 0 | 0 | 0 |
| (c) Loan or Other Cash Injection | | 0 | 0 | 0 | 0 |
| **3. TOTAL CASH RECEIPTS** | 0 | 20,000,000 | 20,500,000 | 21,012,500 | 21,537,813 |
| **4. TOTAL CASH AVAILABLE** | 100,000 | 18,850,000 | 22,367,576 | 26,014,710 | 29,794,641 |
| **5. CASH PAID OUT** | | | | | |
| Purchases (feedstock) | 1,250,000 | 9,900,000 | 10,147,500 | 10,401,188 | 10,661,217 |
| Purchases (packaging) | | 1,385,000 | 1,419,625 | 1,455,116 | 1,491,494 |
| Gross Wages* | | 1,554,000 | 1,592,850 | 1,632,671 | 1,673,488 |
| Laboratory & Testing* | | 25,000 | 25,625 | 26,266 | 26,922 |
| Repairs and Maintenance* | | 200,000 | 205,000 | 210,125 | 215,378 |
| Water & Sewer* | | 5,000 | 5,125 | 5,253 | 5,384 |
| Utilities (electric)* | | 2,128,680 | 2,181,897 | 2,236,444 | 2,292,356 |
| Insurance* | | 120,000 | 123,000 | 126,075 | 129,227 |
| Subtotal | 1,250,000 | 15,317,680 | 15,700,622 | 16,093,138 | 16,495,466 |
| Loan Payment | | 1,164,744 | 1,164,744 | 1,164,744 | 1,164,744 |
| Sinking Fund | | 500,000 | 500,000 | 500,000 | 500,000 |
| **6. TOTAL CASH PAID OUT** | 1,250,000 | 16,982,424 | 17,365,366 | 17,757,882 | 18,160,210 |
| **7. CASH POSITION** | | | | | |
| [End of year] (4 minus 6) | (1,150,000) | 1,867,576 | 5,002,210 | 8,256,828 | 11,634,431 |
| **8. Annual Cash Position (3 minus 6)** | | 3,017,576 | 3,134,634 | 3,254,618 | 3,377,603 |

| | Year 5 | Year 6 | Year 7 | Year 8 |
|---|---|---|---|---|
| **1. CASH ON HAND** | | | | |
| [Beginning of month] | 11,634,431 | 15,138,092 | 18,770,963 | 22,536,275 |
| **2. CASH RECEIPTS** | | | | |
| (a) Cash Sales | 22,076,258 | 22,628,164 | 23,193,868 | 23,773,715 |
| (b) Collections from Credit Accounts | 0 | 0 | 0 | 0 |
| (c) Loan or Other Cash Injection | 0 | 0 | 0 | 0 |
| **3. TOTAL CASH RECEIPTS** | 22,076,258 | 22,628,164 | 23,193,868 | 23,773,715 |
| **4. TOTAL CASH AVAILABLE** | 33,710,689 | 37,766,256 | 41,964,832 | 46,309,990 |
| **5. CASH PAID OUT** | | | | |
| Purchases (feedstock) | 10,927,748 | 11,200,941 | 11,480,965 | 11,767,989 |
| Purchases (packaging) | 1,528,781 | 1,567,000 | 1,606,175 | 1,646,330 |
| Gross Wages* | 1,715,325 | 1,758,208 | 1,802,164 | 1,847,218 |
| Laboratory & Testing* | 27,595 | 28,285 | 28,992 | 29,717 |
| Repairs and Maintenance* | 220,763 | 226,282 | 231,939 | 237,737 |
| Water & Sewer* | 5,519 | 5,657 | 5,798 | 5,943 |
| Utilities (electric)* | 2,349,664 | 2,408,406 | 2,468,616 | 2,530,332 |
| Insurance* | 132,458 | 135,769 | 139,163 | 142,642 |
| Subtotal | 16,907,853 | 17,330,549 | 17,763,813 | 18,207,908 |
| Loan Payment | 1,164,744 | 1,164,744 | 1,164,744 | 1,164,744 |
| Sinking Fund | 500,000 | 500,000 | 500,000 | 500,000 |
| **6. TOTAL CASH PAID OUT** | 18,572,597 | 18,995,293 | 19,428,557 | 19,872,652 |
| **7. CASH POSITION** | | | | |
| [End of year] (4 minus 6) | 15,138,092 | 18,770,963 | 22,536,275 | 26,437,338 |
| **8. Annual Cash Position (3 minus 6)** | 3,503,661 | 3,632,871 | 3,765,312 | 3,901,063 |

| | Year 9 | Year 10 | Year 11 | Year 12 |
|---|---|---|---|---|
| **1. CASH ON HAND** | | | | |
| [Beginning of month] | 26,437,338 | 30,477,546 | 34,660,379 | 40,154,144 |
| **2. CASH RECEIPTS** | | | | |
| (a) Cash Sales | 24,368,058 | 24,977,259 | 25,601,691 | 26,241,733 |
| (b) Collections from Credit Accounts | 0 | 0 | 0 | 0 |
| (c) Loan or Other Cash Injection | 0 | 0 | 0 | 0 |
| **3. TOTAL CASH RECEIPTS** | 24,368,058 | 24,977,259 | 25,601,691 | 26,241,733 |
| **4. TOTAL CASH AVAILABLE** | 50,805,396 | 55,454,806 | 60,262,069 | 66,395,877 |
| **5. CASH PAID OUT** | | | | |
| Purchases (feedstock) | 12,062,189 | 12,363,743 | 12,672,837 | 12,989,658 |
| Purchases (packaging) | 1,687,488 | 1,729,675 | 1,772,917 | 1,817,240 |
| Gross Wages* | 1,893,398 | 1,940,733 | 1,989,251 | 2,038,983 |
| Laboratory & Testing* | 30,460 | 31,222 | 32,002 | 32,802 |
| Repairs and Maintenance* | 243,681 | 249,773 | 256,017 | 262,417 |
| Water & Sewer* | 6,092 | 6,244 | 6,400 | 6,560 |
| Utilities (electric)* | 2,593,590 | 2,658,430 | 2,724,890 | 2,793,013 |
| Insurance* | 146,208 | 149,864 | 153,610 | 157,450 |
| Subtotal | 18,663,106 | 19,129,683 | 19,607,925 | 20,098,124 |
| Loan Payment | 1,164,744 | 1,164,744 | | |
| Sinking Fund | 500,000 | 500,000 | 500,000 | 500,000 |
| **6. TOTAL CASH PAID OUT** | 20,327,850 | 20,794,427 | 20,107,925 | 20,598,124 |
| **7. CASH POSITION** | | | | |
| [End of year] (4 minus 6) | 30,477,546 | 34,660,379 | 40,154,144 | 45,797,754 |
| **8. Annual Cash Position (3 minus 6)** | 4,040,208 | 4,182,832 | 5,493,765 | 5,643,610 |

| | Year 13 | Year 14 | Year 15 | Year 16 |
|---|---|---|---|---|
| **1. CASH ON HAND** | | | | |
| [Beginning of month] | 45,797,754 | 51,594,953 | 57,549,583 | 63,665,579 |
| **2. CASH RECEIPTS** | | | | |
| (a) Cash Sales | 26,897,776 | 27,570,221 | 28,259,476 | 28,965,963 |
| (b) Collections from Credit Accounts | 0 | 0 | 0 | 0 |
| (c) Loan or Other Cash Injection | 0 | 0 | 0 | 0 |
| **3. TOTAL CASH RECEIPTS** | 26,897,776 | 27,570,221 | 28,259,476 | 28,965,963 |
| **4. TOTAL CASH AVAILABLE** | 72,695,530 | 79,165,174 | 85,809,060 | 92,631,542 |
| **5. CASH PAID OUT** | | | | |
| Purchases (feedstock) | 13,314,399 | 13,647,259 | 13,988,441 | 14,338,152 |
| Purchases (packaging) | 1,862,671 | 1,909,238 | 1,956,969 | 2,005,893 |
| Gross Wages* | 2,089,957 | 2,142,206 | 2,195,761 | 2,250,655 |
| Laboratory & Testing* | 33,622 | 34,463 | 35,324 | 36,207 |
| Repairs and Maintenance* | 268,978 | 275,702 | 282,595 | 289,660 |
| Water & Sewer* | 6,724 | 6,893 | 7,065 | 7,241 |
| Utilities (electric)* | 2,862,838 | 2,934,409 | 3,007,769 | 3,082,963 |
| Insurance* | 161,387 | 165,421 | 169,557 | 173,796 |
| Subtotal | 20,600,577 | 21,115,591 | 21,643,481 | 22,184,568 |
| Loan Payment | | | | |
| Sinking Fund | 500,000 | 500,000 | 500,000 | 500,000 |
| **6. TOTAL CASH PAID OUT** | 21,100,577 | 21,615,591 | 22,143,481 | 22,684,568 |
| **7. CASH POSITION** | | | | |
| [End of year] (4 minus 6) | 51,594,953 | 57,549,583 | 63,665,579 | 69,946,974 |
| **8. Annual Cash Position (3 minus 6)** | 5,797,200 | 5,954,630 | 6,115,996 | 6,281,395 |

| | Year 17 | Year 18 | Year 19 | Year 20 |
|---|---|---|---|---|
| **1. CASH ON HAND** | | | | |
| [Beginning of month] | 69,946,974 | 76,397,905 | 83,022,608 | 89,825,429 |
| **2. CASH RECEIPTS** | | | | |
| (a) Cash Sales | 29,690,112 | 30,432,365 | 31,193,174 | 31,973,004 |
| (b) Collections from Credit Accounts | 0 | 0 | 0 | 0 |
| (c) Loan or Other Cash Injection | 0 | 0 | 0 | 0 |
| **3. TOTAL CASH RECEIPTS** | 29,690,112 | 30,432,365 | 31,193,174 | 31,973,004 |
| **4. TOTAL CASH AVAILABLE** | 99,637,087 | 106,830,270 | 114,215,783 | 121,798,433 |
| **5. CASH PAID OUT** | | | | |
| Purchases (feedstock) | 14,696,606 | 15,064,021 | 15,440,621 | 15,826,637 |
| Purchases (packaging) | 2,056,040 | 2,107,441 | 2,160,127 | 2,214,131 |
| Gross Wages* | 2,306,922 | 2,364,595 | 2,423,710 | 2,484,302 |
| Laboratory & Testing* | 37,113 | 38,040 | 38,991 | 39,966 |
| Repairs and Maintenance* | 296,901 | 304,324 | 311,932 | 319,730 |
| Water & Sewer* | 7,423 | 7,608 | 7,798 | 7,993 |
| Utilities (electric)* | 3,160,037 | 3,239,038 | 3,320,014 | 3,403,015 |
| Insurance* | 178,141 | 182,594 | 187,159 | 191,838 |
| Subtotal | 22,739,182 | 23,307,662 | 23,890,353 | 24,487,612 |
| Loan Payment | | | | |
| Sinking Fund | 500,000 | 500,000 | 500,000 | 500,000 |
| **6. TOTAL CASH PAID OUT** | 23,239,182 | 23,807,662 | 24,390,353 | 24,987,612 |
| **7. CASH POSITION** | | | | |
| [End of year] (4 minus 6) | 76,397,905 | 83,022,608 | 89,825,429 | 96,810,821 |
| **8. Annual Cash Position (3 minus 6)** | 6,450,930 | 6,624,704 | 6,802,821 | 6,985,392 |

| | Total 20 years |
|---|---|
| **1. CASH ON HAND** | |
| [Beginning of month] | |
| **2. CASH RECEIPTS** | |
| (a) Cash Sales | 275,911,059 |
| (b) Collections from Credit Accounts | 0 |
| (c) Loan or Other Cash Injection | 0 |
| **3. TOTAL CASH RECEIPTS** | 275,911,059 |
| **4. TOTAL CASH AVAILABLE** | |
| **5. CASH PAID OUT** | |
| Purchases (feedstock) | 136,575,974 |
| Purchases (packaging) | 19,106,841 |
| Gross Wages* | 21,438,289 |
| Laboratory & Testing* | 344,889 |
| Repairs and Maintenance* | 2,759,111 |
| Water & Sewer* | 68,978 |
| Utilities (electric)* | 29,366,318 |
| Insurance* | 1,655,466 |
| Subtotal | 211,315,866 |
| Loan Payment | 11,647,440 |
| Sinking Fund | 6,000,000 |
| **6. TOTAL CASH PAID OUT** | 228,963,306 |
| **7. CASH POSITION** | |
| [End of year] (4 minus 6) | |
| **8. Annual Cash Position (3 minus 6)** | 46,947,754 |

* items inflated at an annual rate of 2.5%

## Appendix A

### Study Steering Committee

| | |
|---|---|
| Robert Turner | R.J. Turner Company |
| Bob De Geus | VT Dept. of Forests, Parks & Recreation |
| Matt Langlais | VT Dept. of Forests, Parks & Recreation |
| Rich Carbonetti | Land Vest |
| Jim Wood | North Country Environmental |
| Ken Davis | Logger & VT Logger Association Representative |
| Brian Roy | Property Owner |
| Rocky Bunnell | Logger |
| Jock Gill | Pellet Futures |
| Paul Brouha | Town of Sutton and Project Coordinator |
| Laurie Zilbauer | NVDA |

## Appendix B

The following text from the Emergency Economic Stabilization Act of 2008 (HR1424) demonstrates the available tax credit for biomass stove purchase. The full text of the Act is available online at: http://financialservices.house.gov/press110/essabill.pdf.

**SEC. 302. CREDIT FOR NONBUSINESS ENERGY PROPERTY**

• 'from January 1, 2009 to December 31, 2009'
• 'a stove which uses the burning of biomass fuel to heat a dwelling unit located in the United States and used as a residence by the taxpayer, or to heat water for use in such a dwelling unit, and which has a thermal efficiency rating of at least 75 percent.'
• 'BIOMASS FUEL- The term 'biomass fuel' means any plant-derived fuel available on a renewable or recurring basis, including agricultural crops and trees, wood and wood waste and residues (including wood pellets), plants (including aquatic plants), grasses, residues, and fibers.'

## Appendix C

### Annual Capital Payments – 80% Debt Financing at Various Interest Rates

| | | | | |
|---|---|---|---|---|
| **Capital Cost** | $ | 8,000,000 | | |
| **Interest Rate** | *annual* | | *monthly* | |
| **5.50%** | $ | 1,041,852 | $ | 86,821 |
| **5.75%** | $ | 1,053,780 | $ | 87,815 |
| **6.00%** | $ | 1,065,792 | $ | 88,816 |
| **6.25%** | $ | 1,077,888 | $ | 89,824 |
| **6.50%** | $ | 1,090,056 | $ | 90,838 |
| **6.75%** | $ | 1,102,308 | $ | 91,859 |
| **7.00%** | $ | 1,114,632 | $ | 92,886 |
| **7.25%** | $ | 1,127,040 | $ | 93,920 |
| **7.50%** | $ | 1,139,532 | $ | 94,961 |
| **7.75%** | $ | 1,152,096 | $ | 96,008 |
| **8.00%** | $ | 1,164,744 | $ | 97,062 |
| **8.25%** | $ | 1,177,464 | $ | 98,122 |
| **8.50%** | $ | 1,190,256 | $ | 99,188 |
| **8.75%** | $ | 1,203,132 | $ | 100,261 |
| **9.00%** | $ | 1,216,080 | $ | 101,340 |
| **9.25%** | $ | 1,229,112 | $ | 102,426 |
| **9.50%** | $ | 1,242,216 | $ | 103,518 |
| **9.75%** | $ | 1,255,392 | $ | 104,616 |
| **10.00%** | $ | 1,268,640 | $ | 105,720 |

Assumes 10 years (120 monthly payments).

## Appendix D

**Sensitivity of Return on Investment to Pellet Prices**

| | Wholesale Price of Pellets (per ton) | | | | | |
|---|---|---|---|---|---|---|
| | $140.00 | $160.00 | $180.00 | $200.00 | $220.00 | $240.00 |
| Profit (annual, before interest and taxes) | (2,982,424) | ($982,424) | 1,017,576 | 3,017,576 | 5,017,576 | 7,017,576 |
| Net Present Value (NPV) | ($38,944,218) | (17,111,296) | 4,721,626 | 26,554,548 | 48,387,470 | 70,220,392 |
| Return on Investment (ROI) at 8% | -540% | -267% | 6% | 279% | 552% | 825% |

This table assumes change in price of pellets without a similar change in feedstock prices, an unlikely scenario.

## Appendix E

### Sensitivity of Return on Investment to Roundwood Prices

| | Purchase Price for Roundwood | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $30.00 | $35.00 | $40.00 | $45.00 | $50.00 | $55.00 | $60.00 | $65.00 |
| Profit (annual, before interest and taxes) | 6,977,576 | 5,987,576 | 4,997,576 | 4,007,576 | 3,017,576 | 2,027,576 | 1,037,576 | 47,576 |
| Net Present Value (NPV) | 69,783,733 | $58,976,437 | 48,169,141 | 37,361,844 | 26,554,548 | 15,747,252 | 4,939,955 | (5,867,341) |
| Return on Investment (ROI) at 8% | 819% | 684% | 549% | 414% | 279% | 144% | 9% | -126% |

This table assumes change in price of feedstock without a similar change in pellet prices, an unlikely scenario.

## Appendix F

**Sensitivity of Return on Investment to Roundwood and Pellet Prices**

| **Roundwood ($ / green ton)** | **Pellet Sale Price ($ / ton)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | $ 140 | $ 160 | $ 180 | $ 200 | $ 220 | $ 240 | $ 260 |
| $ 30.00 | 0% | 273% | 546% | 819% | 1092% | 1365% | 1638% |
| $ 35.00 | -135% | 138% | 411% | 684% | 957% | 1230% | 1503% |
| $ 40.00 | -270% | 3% | 276% | 549% | 822% | 1095% | 1368% |
| $ 45.00 | -405% | -132% | 141% | 414% | 687% | 960% | 1233% |
| $ 50.00 | -540% | -267% | 6% | 279% | 552% | 825% | 1098% |
| $ 55.00 | -675% | -402% | -129% | 144% | 417% | 690% | 962% |
| $ 60.00 | -810% | -537% | -264% | 9% | 282% | 554% | 827% |
| $ 65.00 | -945% | -672% | -399% | -126% | 146% | 419% | 692% |
| $ 70.00 | -1080% | -807% | -534% | -262% | 11% | 284% | 557% |

## Sources & Endnotes

[i] The USDA Forest Inventory & Analysis does not track individual markets (e.g., mills), but INRS makes the assumption that all roundwood harvested has a market.
[ii] North East State Foresters Association. *Carbon Sequestration and Its Impacts on Forest Management in the Northeast.* December 19, 2002.
[iii] USDA Forest Service – Forest Inventory & Analysis Mapmaker v3.0. http://fia.fs.fed.us/tools-data/ Data years used: VT 1997, NH 1997. More recent statistically complete data exists for New Hampshire but not Vermont, and due to a change in collection methodologies the new (2001 – 2006) and older (1997) data may not be fully compatible. For this reason, older (1997) data was used exclusively.
[iv] FIA information is presented in cubic feet. All conversions were made assuming 85 cubic feet of solid wood per cord, and that a green cord weighs 2.4 tons for softwood and 2.6 tons for hardwood species.
[v] INRS used information from FIA surveys in 1997 for counties in Vermont and New Hampshire. This is the last year that complete information is available for. The FIA has since move to annualized inventories, and four out of fiver partial survey years are publicly available. INRS did not use this partial information because it is complete. However, the new information suggests lower growth rates that the 1997 surveys did. INRS was conservative when estimating wood available to market; allowing for the lower growth rates and other factors.
[vi] FIA data is available and presented by county. However, the county is a very small sample size, and is best considered in aggregate with other counties. Information from individual counties should be viewed with caution.
[vii] The net growth figures presented here have a Sampling Error of 9.5% for the Core Counties and 5.3% for the Core and Buffer Counties. Sampling Error for individual counties can be considerably higher.
[viii] Innovative Natural Resource Solutions LLC. *Biomass Availability Analysis – Five Counties of Western Maine.* Prepared for the Massachusetts Division of Energy Resources and the Massachusetts Department of Conservation & Recreation. January 2007.
[ix]Establishing Long-Term Supply Agreements for Wood Energy Facilities Empire State Forest Products Association, June 2008, report under review.
[x] Assumes standing wood (stumpage) price of $2/ton of wood for whole tree chips and $500/one thousand board feet of sawlog material.
[xi] This assumes that additional volumes of wood can be made available if chipping and whole tree harvesting was part of most timber harvesting operations. Calculation assumes 20 additional tons or 8.3 cords additional per acre harvested if whole tree harvesting occurs without cutting any additional trees. This volume comes primarily from top wood, lower quality stem portions or, in rare cases, trees of lower than pulpwood quality. Assumes up to 3% of acreage is harvested in a year for large landowners and 10% for UVA lands.
[xii] This range is based on a wide range of acreages and is a range of stocking by ownerships, not acres.
[xiii]Based on actual harvest volume data for Coos County, New Hampshire, 1998 – 2005. NH Report of Cut Forms, provided by the NH Division of Forests & Lands (Matt Tansey, personal communication, February 2008).

**Other Organizations and Individuals Consulted**

Pellet Fuels Institute - www.pelletheat.org

Hearth, Patio and Barbecue Association - www.hpba.org

International Wood Fuels, Inc. – Consulted with CEO Steve Mueller about plans for the Sutton site.

Energy Information Administration of the US Department of Energy - www.eia.doe.gov/ Many data sets consulted relative to fossil fuels and biomass related fuels and energy.

Austrian Pellet Industry Association - www.bioenergy.at

New England Wood Pellet – personal communication with Charlie Niebling, General Manager and Steve Walker, CEO

The Bioenergy International – various newsletters including issue #35 - www.bioenergyllc.com/

Personal communication with Paul Brouha and other members of the Steering Committee for this project.

Various pellet and wood processing equipment manufacturing and sales companies.

Various loggers and suppliers of raw material.