PFPI
driven by data

Critique of INRS wood availability studies for the Beaver and Winstanley facilities in Vermont

September 9, 2012

To the ANR:
As the role of biomass energy in Vermont's renewable energy portfolio is increasingly discussed, it is important to consider what large-scale biomass facilities mean for forests and greenhouse gas emissions in Vermont. The purpose of this memo is to summarize and critically analyze the biomass availability studies conducted by Innovative Natural Resource Solutions (INRS) for the Beaver (Fair Haven) and Winstanley (North Springfield) biomass facilities in Vermont.

The proposed Beaver Fair Haven plant is a pellet manufacturing and biomass energy plant (34 MW) that the INRS study states will require around 550,000 tons of wood per year, mostly from whole-tree harvesting. The proposed Winstanley plant (25 – 35 MW) will require around 440,000 green tons of wood per year. If built, these and other biomass energy plants in Vermont will put significant new demands on the state's forests, as well as dramatically increasing greenhouse gas emissions from Vermont's power sector. However, as outlined below, the INRS studies that were commissioned to analyze impacts from these plants contain a number of serious flaws, including over-representing the amount of wood available as biomass fuel, under-representing impacts from forest harvesting, and ignoring or downplaying greenhouse gas emissions from biomass energy. Because the INRS studies are likely to be invoked in discussions about biomass energy, and because busy policy-makers are unlikely to evaluate the INRS studies on their own, this memo provides some of the critical scrutiny these studies deserve.

The INRS studies downplay or ignore greenhouse gas emissions from biomass energy
Despite its frequent portrayal as "carbon neutral", biomass power plants actually emit more CO2 than coal or gas plants, per unit energy generated.[1] This is simple physics – it is not controversial. So why has biomass so frequently been portrayed as carbon neutral? The idea of carbon neutrality has often been justified with the claim that biomass facilities burn "waste" wood (i.e., forest residues) for fuel

[1] Conveniently for accounting purposes, burning one ton of green wood emits almost exactly one ton of CO_2.

– wood that, if left unburned, would decompose within a relatively short time and emit the same amount of CO_2 as burning it for energy emits. Leaving aside a discussion of the merits of this idea, it is clear that when new trees are cut to provide biomass fuel that would not otherwise be cut, the justification that biomass is "only waste" does not apply. In fact, cutting and burning trees for fuel creates a "carbon debt" that takes decades to erase as forests grow back. This is the reason that Vermont's neighbor Massachusetts has drafted new regulations that require biomass power plants to track how much "whole tree" fuel they use, and account for their CO_2 emissions – even emissions from so-called waste wood. Facilities must be at least 50% efficient *and* must have 20-year lifecycle carbon emissions that are no more than 50% those from a natural gas plant to qualify for Renewable Energy Certificates (RECs) in Massachusetts, and even at 50% efficiency, a facility only receives one-half REC per megawatt-hour (facilities get a full REC per MWhr when they are 60% efficient). In other words, the State of Massachusetts is taking the problem of carbon emissions from biomass power very seriously. [2]

Building large-scale biomass energy plants in Vermont will require increased forest harvesting – the INRS reports make that clear. Thus, citizens and policy-makers who care about climate change – and forests – have every reason to be concerned about the impacts from these facilities. Yet the INRS studies are silent on the greenhouse gas emissions issue, and even misleading as to the impacts of harvesting and burning residues and trees for fuel. The INRS studies assume that as long as forest growth in the region exceeds harvesting, this is sufficient to assure that harvesting will be sustainable – and by implication, "carbon neutral." However, keeping forest harvesting below net growth does not assure carbon neutrality, because forests can't regrow as fast as trees are burned, and because the remaining, uncut forests (which are already unable to sequester carbon as fast as it's emitted) do not instantaneously increase their rate of carbon uptake to assimilate the greater amount of CO_2 that biomass energy produces relative to fossil fuels.[3]

INRS reports overestimate biomass fuel availability

The INRS studies employ the convention of assuming a "harvest radius" of 30 – 50 miles within which biomass facilities are assumed to obtain their fuel. However, the area of the fuel shed actually available for biomass harvesting is constrained by the land use and accessibility, its legal status and ownership, and its current harvesting intensity.

The INRS studies omit critical factors in evaluating fuel availability. In responses to interrogatories submitted by the Vermont Natural Resources Council to the Vermont Public Service Board, INRS has admitted that the fuel availability studies do not take into consideration the following factors:

1. Landowner willingness to harvest
2. Physical factors that can influence the ability to harvest, like steep slopes
3. Protected areas like wetlands and sensitive ecosystems
4. Wildlife habitat elements like deer wintering areas

These are serious omissions which greatly influence the actual availability of wood.

[2] Regulations available at http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/biomass/renewable-portfolio-standard-biomass-policy.html

[3] Some claim that pointing out these physical facts amounts to an endorsement of continued unmitigated use of fossil fuels. It is not. It is simply a correction to a widely propagated, but incorrect, idea that "sustainable harvesting" of biomass produces "carbon neutrality".

Figure 1 shows 50-mile harvesting buffers for the existing and proposed facilities that are identified in the INRS reports (a facility list that is not comprehensive). The amount of wood (green tons/year) used by each facility is included on the label. As is apparent from the map, there is very substantial overlap of many of these fuel sheds, including between the proposed facilities in Fair Haven and North Springfield, which will be 45 miles apart.

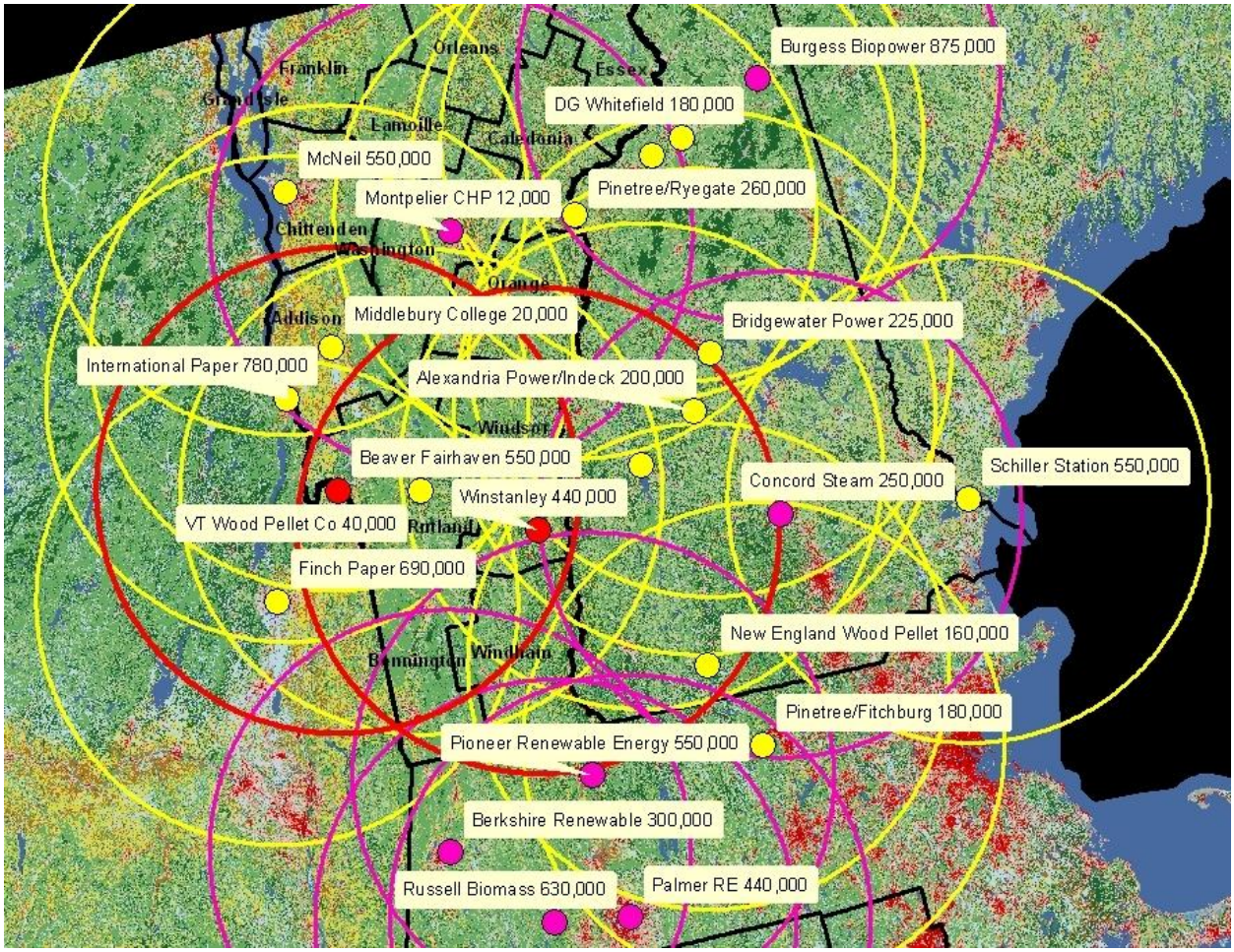

Figure 1. Overlapping 50-mile harvest radius areas of existing (yellow) and proposed (pink, and red for Beaver and Winstanley) wood-using facilities in Vermont and surroundings. The amount of fuel (green tons/year) used by each facility is noted.

Large areas of land are not legally harvestable or do not contain trees

Land ownership and usage can limit the availability of whole tree harvesting or residues for fuel. In the case of the Beaver facility's fuel shed, a substantial portion of this area is occupied by the Green Mountain National Forest, which the INRS report acknowledges is not an eligible biomass-producing area, but also the wilderness/no logging areas in the Adirondacks, which the INRS report *fails* to acknowledge as being off-limits to harvesting.

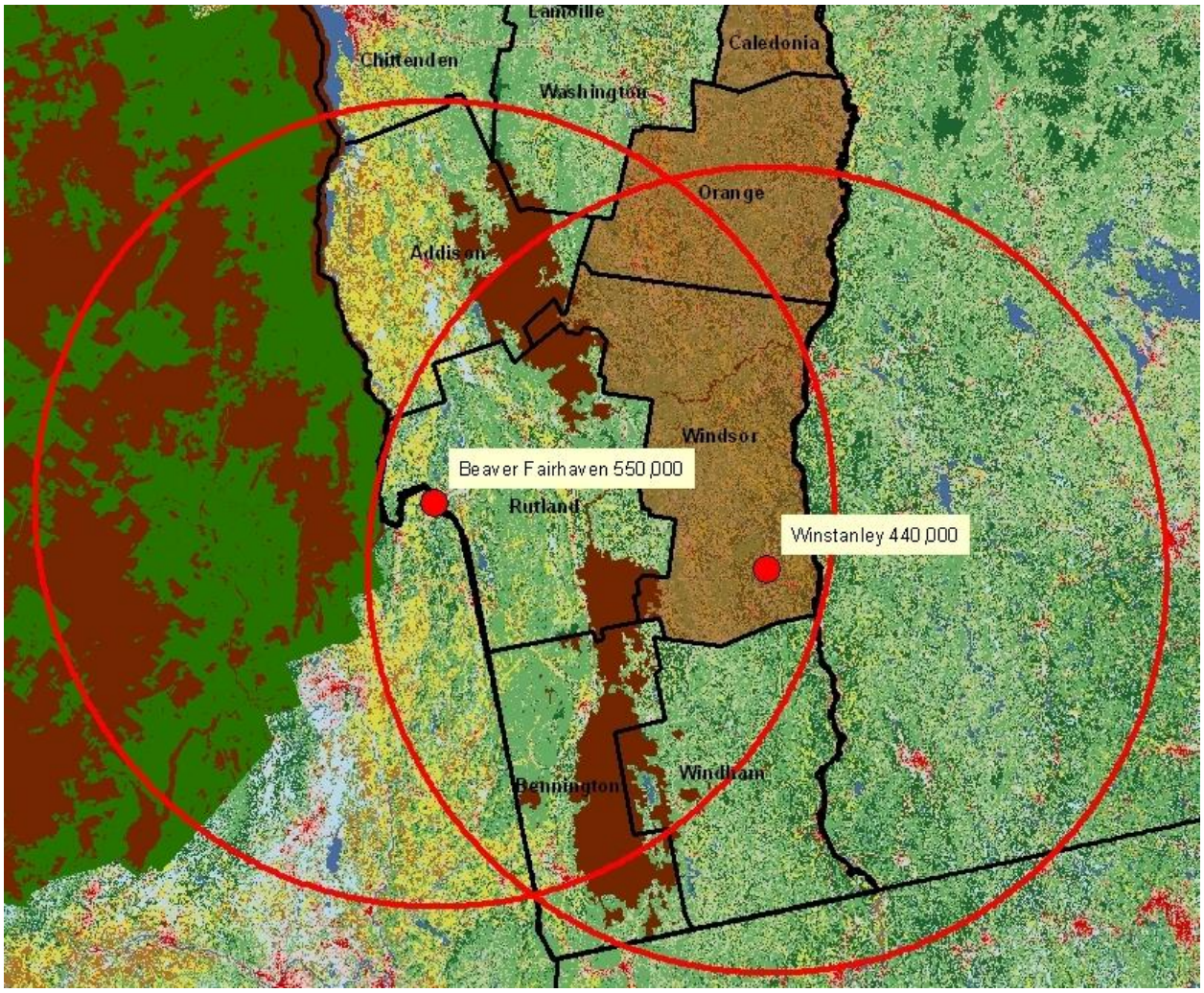

Figure 2. Overlapping harvest areas of Beaver and Winstanley facilities, excluding woodsheds of other facilities for clarity. Areas in the Adirondacks and the Green Mountain National Forest that are off limits for biomass harvesting are denoted with dark brown, and counties noted by the Biomass Energy Resource Center (BERC) as having exceptionally small amounts of "net available low grade wood" available are shaded medium brown. The underlying map is the National Land Use Dataset (2006); green indicates forest cover, while yellow generally indicates agricultural areas.

Further, agricultural landscapes, which are obviously not a source of woody biomass fuel, constitute a significant portion of the remaining Beaver fuelshed that is not legally reserved from harvesting (areas in yellow on the maps are predominantly agricultural). This means that areas that *are* considered harvestable will bear an even heavier burden, yet these are largely areas that overlap the fuel shed of the Winstanley plant, as well as numerous other plants in the area.

The INRS studies do not fully account for existing use of low grade wood
Numerous wood-using facilities with their overlapping woodsheds already put demands on Vermont's forests. However, although the INRS studies include data on existing demand for low-grade wood, INRS's proprietary approach for determining wood availability is not transparent, and is therefore difficult to evaluate. The INRS estimates of biomass fuel availability in the Beaver and Winstanley fuelsheds (990,000 tons, which includes wood from outside Vermont) differ from those of the Biomass Energy Resource Center's (BERC) 2010 estimate[4] of wood availability, which concludes 894,900 green tons per year of "net available low-grade wood" (NALG) are available in the entire state of Vermont under a "moderate" harvesting scenario. Importantly, the BERC study concludes that two counties in the fuel sourcing area have very little available wood, concluding that "*Caledonia County has no remaining NALG wood, little remains in Orange, and surprisingly little remains in Windsor given the large forested land area*" (these counties are marked in pale brown in Figure 2). Combining this land area with the park and national forest areas reserved from harvesting leaves very little forest area remaining to supply new facilities.

The inclusion by INRS of out-of-state areas as biomass sourcing regions for the Beaver and Winstanley plants, and the characterization of fuelsheds as crossing county lines, makes it difficult to compare directly with the BERC study, which characterizes biomass availability county by county. However, much of the out-of-state area that INRS identifies as a fuelshed for the Beaver plant lies in the Adirondacks and includes large areas reserved from harvesting; and much of the out-of-state area identified for the Winstanley plant includes areas of New Hampshire that already provide fuel and woody feedstock to a number of New Hampshire wood-users. Thus, the INRS studies likely overestimate of biomass availability significantly, compared to the BERC study which, while making too many assumptions of its own, is more realistic.

Assumption that 50% of forestry residues are available as fuel is unrealistic
New biomass facilities in Vermont will chiefly burn two main categories of wood: forestry residues (the tops, branches, and unmerchantable trees cut during harvesting) and "low value" whole trees . The INRS studies conclude that forestry residues can met a large proportion of fuel demand by the Beaver and Winstanley facilities. For instance, the Beaver study estimates that about 350,000 tons of residues are generated each year in the four Vermont and three New York counties surrounding the Fair Haven site, and states, "*Of this, roughly half (175,000 green tons) can be captured and used as biomass fuel; the rest is left in the forest*".[5] The North Springfield study estimates that 400,000 tons of residues are generated around North Springfield, and concludes, "*in our experience, roughly half of this could be available to market*".[6]

However, the assumption that one-half forestry residues are available as fuel is highly unrealistic. If, as the INRS report states, one half of residues in a region are left in the forest,[7] then the other half that is to be "captured and used as biomass fuel" must come from harvesting the remainder on every single acre that has been logged. This is clearly an impossibility. Many regions are inaccessible to chipping equipment and chip transport trucks, many loggers do not harvest residues, and some

[4] Biomass Energy Resource Center, 2010. Vermont Wood Fuel Supply Study, 2010 Update. Montpelier, VT. Page 5
[5] Page 14 INRS Fair Haven study
[6] Page 21 INRS North Springfield study
[7] Sustainable forestry is thought to require leaving at least one-third to one-half of forestry residues on site to maintain soil fertility and protect against erosion. However, no long-term studies have been conducted to determine whether this guideline is actually protective of soil nutrient status or other forest functions over time.

landowners may not be willing to have loggers harvest residues on their land. Furthermore, the INRS studies provide no estimates of what proportion of residues are *already* harvested by existing wood-users, but the amount is likely to be high in some areas, given BERC's estimates that almost no low-grade wood remains in key Vermont counties that are part of the fuelsheds of both facilities.

Biomass harvesting relies on other harvesting for commercial viability
The INRS studies point out that the economic viability of biomass harvesting depends on commercial timber harvesting: "*Loggers and landowners make their money from growing, harvesting and selling veneer, sawlogs and (to a much lesser extent) pulpwood. The health of these markets, particularly sawlogs, is what allows people the economic opportunity to conduct a timber harvesting operation. If these markets suffer a significant downturn, less biomass may be available in the marketplace because fewer individuals will conduct timber harvesting operations".*[8]

Since, as the studies point out, biomass harvesting generally accompanies and depends on commercial timber harvesting, it is not clear how INRS can conclude that a large amount of low-grade wood is "available" for biomass without an accompanying expansion in commercial timber harvesting. Yet the studies conclude,

"*With all large markets in place and operating, the 30 miles*[9] *surrounding North Springfield, VT (private land only) , annual harvest [sic] levels exceed harvest levels by nearly 470,000 green tons of non-sawlog material*"[10] and, "*With all large markets in place and operating, for the 50 miles surrounding Fair Haven, VT, annual growth of roundwood exceeds harvest by over 1,000,000 green tons per year. When sawlogs are excluded, assuming this portion of a harvest economically unviable as biomass or pellet feedstock, annual growth exceeds removals by over 870,000 green tons per year*".

The assertion that the growth of low-grade wood currently exceeds harvesting removals is the *sole rationale* provided by the INRS studies that more biomass is available for harvesting. Yet harvest data from 2008[11] show that the combined harvest of low-grade wood for pulpwood, whole tree chips for fuel, and firewood already exceeds the harvest of high-quality logs for sawtimber in Vermont (Figure 3), suggesting that there is little more low-grade wood available on the areas that are being harvested each year. As the INRS studies point out, extraction of low-grade wood for fuel is not economic unless it accompanies commercial sawtimber harvesting, but no such expansion is occurring.

8 Page 5 INRS North Springfield study
9 The INRS study assumes 30 mile radius for North Springfield and 50 mile radius for Fair Haven. However, there is no justification for assuming that wood suppliers will stick to these limits. Just because a plant is smaller doesn't change the economics – they pay what they pay for a ton of chips and if it's worth delivering it from 50 miles at one facility, it will also be worth it at another facility. In fact, it is already the case that chips come from further than 50 miles in some cases.
10 Table 3 on page 25 of the INRS North Springfield study
11 Vermont Agency of Natural Resources. 2010 Vermont Forest Resources Plan. Page 81.

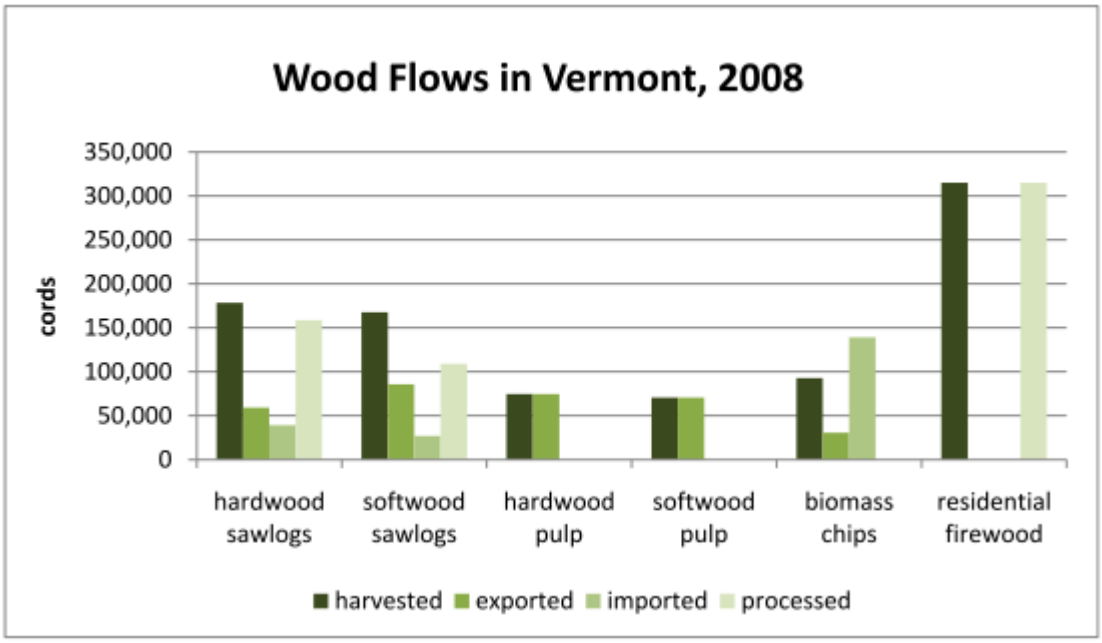

Figure 3. Wood harvested for different uses in Vermont, 2008. Reproduced from Vermont Agency of Natural Resources 2010 Vermont Forest Resources Plan.

INRS projections rely on destructive harvesting practices, low-cost fuel, and lack of competition
Revealingly, the INRS report for North Springfield essentially warns that keeping biomass affordable requires a "wild west" approach to harvesting, since fuel prices in the study[12] *"assume that no outside restrictions are put on timber harvesting for biomass. The two facilities currently operating in Vermont – McNeil Station and Pinetree Ryegate – have 'harvest standards' placed on the facilities through the Vermont Public Service Board.* ***If the PSB or the legislature placed harvest standard restrictions on new biomass electric facilities located in Vermont – or if the North Springfield Energy Project adopts such standards voluntarily – it is likely the cost for fuel would increase"*** *(emphasis added).*

In other words, if guidelines are put in place to protect forests, biomass energy becomes uneconomic.

Biomass electricity is expensive to produce, which is why it relies so heavily upon tax credits and renewable energy subsidies. Many facilities operate with slim margins where relatively small changes in the cost of fuel make them uneconomic to operate. As the INRS reports show, wood chip costs can be quite variable and sometimes difficult to obtain; for instance, the Winstanley report devotes a great deal of space to explaining the logistical difficulties of harvesting and chipping residues and low grade wood.[13] The cost of biomass is closely tied to diesel fuel prices, for as INRS point out, it requires about 2.1 gallons of diesel to harvest and transport each ton of chips.

Competition for biomass fuel can also drive up its price. The Winstanley report warns[14] that price estimates for biomass at a range of diesel costs "*should be viewed as an average annual price; actual*

[12] INRS North Springfield report, Table 5, page 34
[13] Page 21, INRS North Springfield report
[14] Page 34, INRS North Springfield report

pricing will change regularly based upon weather, season, changes in the marketplace and other factors. ***These prices do not anticipate the entrance of a major new market for low-grade wood in close proximity to North Springfield***" *(emphasis added).*

The warning that competition for fuel could affect costs should be taken seriously. Between existing and proposed facilities, there are 20 other wood-using facilities listed in the report as potentially impacting the North Springfield plant.

Other biomass studies estimate lower fuel availability

In addition to the BERC study, another independent assessment of biomass availability in Vermont and surrounding states was conducted by the Cary Institute of Ecosystem Studies.[15] Like the INRS studies, the Cary Institute considered privately owned land to be the main potential source of biomass, but unlike the INRS study, it took into account factors such as topography and landowner attitudes toward harvesting that can reduce its availability. Critically, the Cary Institute study analyzed whether harvesting exceeds growth rates on "working lands," only, unlike the INRS studies, which count growth occurring on *all* lands, including lands reserved from harvesting, when determining whether harvest levels unsustainably exceed growth levels in the state.

While acknowledging that the study had not analyzed the greenhouse gas impacts of harvesting, the Cary Institute study determined that between 411,000 and 824,000 green tons of biomass could be harvested in the whole state of Vermont each year (the upper limit is similar to BERC's "moderate" scenario which estimates 894,000 tons are available). Current harvesting in Vermont was determined by the Cary Institute study to be 67% of net growth for all forests (including reserved lands) in the state as a whole. Considering that about one-third of lands are not harvestable for various reasons,[16] this means that working lands may already be at or near the tipping point where harvests exceed growth rates.

[15] Buchholz, T., Canham, C., and Hamburg, S. 2011. Forest biomass and bioenergy: opportunities and constraints in the Northeastern United States. Cary Institute of Ecosystem Studies, Millbrook, NY. February 17, 2011.

[16] BERC's analysis considers that only about 41% of Vermont's forestland is potentially available for biomass extraction, with 59% unlikely to be harvested – an estimate that is close to that of the Cary Institute.