North Country Forest Energy Project

Wood Heating in Coos County, New Hampshire
Second-Year Activities

Report to the Neil and Louise Tillotson Fund of the
New Hampshire Charitable Foundation • April 2009

Biomass Energy Resource Center
This report was written by the Biomass Energy Resource Center to describe the second-year activities of the North Country Forest Energy Project to the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation.

**Biomass Energy Resource Center**

The Biomass Energy Resource Center’s (BERC) mission is to achieve a healthier environment, strengthen local economies, and increase energy security across the United States by developing sustainable biomass energy systems at the community level. BERC is a national non-profit with expertise in institutional and community-scale wood energy systems to help industries, schools, and institutions initiate and implement biomass projects for their heating and power needs. Since 2005, BERC has worked with partners and stakeholders in New Hampshire and the other Northern Forest states to actively explore the potential for transforming the energy economies of the region’s communities by substituting locally supplied wood fuel for fossil fuels in heating, power production, combined heat and power (CHP), and distributed generation.
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Coos County buildings (from top clockwise): Androscoggin Valley Hospital, Whitefield Elementary School, White Mountains Regional High School, and Lancaster Elementary School.
I. EXECUTIVE SUMMARY

OVERVIEW
This report summarizes the second year of work on the North Country Forest Energy Project made possible by a grant from the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation.

In the first year of this project, the Biomass Energy Resource Center (BERC) implemented a three-part strategy to address and advance biomass energy development and use in Coos County. Facilities in the county were screened for biomass heating potential, the foundation was laid for a statewide program promoting community-scale biomass heating, and creative financing mechanisms for biomass projects were explored.

In this second year, BERC built on first-year activities with a four-part strategy to further support the use of biomass energy in Coos County.

First, feasibility studies were undertaken for sites identified in year one as having a good potential for biomass heating. These studies included economic analysis, fuel supply assessment, logistical considerations, and information on biomass heating technologies and benefits. The findings will inform the decision to pursue biomass energy at each facility. BERC completed, or at the time of this report is nearing completion of, seven feasibility studies, six for schools and one for a district energy system in Berlin, New Hampshire. These studies are available in separate reports.

Second, BERC promoted the concept of biomass heating and laid the groundwork for supporting conversion to biomass energy where feasible.

Third, BERC partnered with state, regional, and local agencies to provide a policy foundation for implementing a New Hampshire Community-Scale Biomass Heating Program.

Fourth, BERC identified funding options available for biomass heating projects and examined mechanisms to ensure successful implementation.

FEASIBILITY STUDIES
Detailed feasibility studies have shown several facilities in Coos County to be a good match for biomass heating. Three studies were completed, with four more to be completed in the spring of 2009. The completed studies were well received, with plans to immediately go forward with at least one of the projects.

BERC met with facility decision makers to assess logistical feasibility and gather data on fuel and electrical use for each site. The studies include an economic analysis, site-specific design considerations, fuel supply assessment, information on biomass technologies and benefits, and recommended steps to move each project forward. Regional fuel supply considerations and characteristics have not changed considerably since BERC completed a regional assessment during the first year. The more detailed and localized fuel assessments completed in this second year built on that work.

In addition to feasibility studies for individual facilities, biomass-fueled district energy is being considered as an option by the communities of Groveton, Lancaster, and Berlin. BERC reviewed studies already completed for Lancaster and Groveton, and is currently completing a feasibility study for district heating in Berlin. Preliminary analysis using fuel consumption estimates shows Berlin to be a good site for a district energy system, and advanced technologies are being assessed (separate funding) and more detailed fuel consumption data is being gathered, with a final report anticipated by the summer of 2009.
PROGRAM DEVELOPMENT
BERC strengthened partnerships with and among state, local, and regional agencies to establish a statewide program to implement community-scale biomass projects in which policy groundwork was proposed and promoted. Funds were provided by the US Department of Agriculture Jumpstart Program to complete additional feasibility studies on facilities throughout the state. Partners in the New Hampshire Community-Scale Biomass Heating Program have continued to meet regularly and, in addition to the feasibility studies, have developed promotional materials, convened workshops, and organized site visits to biomass heating plants.

CREATIVE FINANCING
BERC explored the financing mechanisms that already exist for biomass heating projects and helped to develop new models that will fill some of the gaps in existing financing mechanisms. Potential synergies between both existing and developing mechanisms were also explored. BERC continues to develop a nonprofit energy services model that could help facilitate biomass and other renewable energy projects, along with several other mechanisms.

CONCLUSION
Building on the strong foundation of the first year’s work, BERC continued to promote biomass heating in Coos County during the second year of activities.

Support for the North Country Forest Energy Project by the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation has allowed BERC to:

• Strengthen the community heating program in New Hampshire
• Identify and prioritize ideal sites for wood energy projects
• Investigate creative ways to finance them

BERC identified a clear need for greater information and public education activities to promote the benefits of biomass heating in the communities of Coos County. There was limited interest by some in participating in feasibility studies for the project, despite the opportunity to do so at no cost through this project.

A pilot project in Coos County would demonstrate the efficiency and ease of modern wood-burning technology, and also the economic benefits to the facility and the local economy. BERC is working with the Grafton County commissioners in the adjacent county to construct a biomass plant to heat the county’s complex in nearby North Haverhill, New Hampshire. This project is expected to be constructed in 2010 and might well serve as another pilot project for the area; however, BERC is committed to support feasible pilot projects in Coos County as a high priority for its work.

BERC continues working with partners in the New Hampshire Community-Scale Biomass Heating Program to promote biomass heating throughout the state, and with partners at the facilities studied here to implement successful projects in Coos County.

This significant work would not have been possible without support from the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation, and BERC is extremely appreciative of this support.

A pilot project in Coos County would demonstrate the efficiency and ease of modern wood-burning technology, and also the economic benefits to the facility and the local economy.
II. INTRODUCTION

BACKGROUND
In 2005, the Biomass Energy Resource Center (BERC) engaged with partners and stakeholders in New Hampshire and the other Northern Forest states to actively explore the potential for transforming the energy economies of the region’s communities through substituting locally supplied wood fuel for fossil fuels in heating, power production, combined heat and power (CHP), and distributed generation.

The North Country Forest Energy Project is developing the potential for woody biomass to become both a viable energy source and an economic development driver for the North Country. BERC is focusing on project, program, and policy development in Coos County, New Hampshire.

The Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation awarded BERC a $75,000 grant in February 2007 to support the project’s first-year activities and a second grant of $75,000 in March 2008 to support second-year activities.

This report summarizes the accomplishments during the second year of funding from the Neil and Louise Tillotson Fund to study the potential for and support the use of biomass energy in Coos County.

PROJECT DESCRIPTION
The North Country Forest Energy Project aims to increase the use of sustainably supplied woody biomass in municipal, public, and institutional energy applications that will:

- Reduce operating budgets for municipalities, schools, and other institutions
- Keep energy dollars circulating in local economies instead of exporting those dollars
- Create jobs
- Sustain, revitalize, and empower communities
- Strengthen the forest products industry
- Improve forests and benefit forestland owners
- Provide energy security
- Reduce climate change emissions in a meaningful way

In the first year of this project, BERC implemented a three-part strategy to address and advance biomass energy development and use in Coos County.

First, BERC set the program foundation for advancing a conversion of schools from fossil-fuel heat to biomass by engaging policy makers and state agencies in the need and value of such a program.

Second, BERC screened approximately 50 sites in Coos County for suitability for conversion from fossil fuel heat to biomass heat or combined heat and power (CHP), and narrowed the list down to 23 sites and two community districts with the most potential for additional feasibility work to be performed.

Third, BERC investigated and reported on creative financing mechanisms that might be available to facilitate implementation of these identified projects.

In addition to the above, BERC conducted a fuel supply assessment for the region of Coos County and the adjacent counties.
SCOPE OF WORK

Efforts in the second year of the North Country Forest Energy Project are designed to combine on-the-ground project development with the creation of programmatic structures to support project activities over the long term. They build on the results of first-year activities and are being carried out under a four-part strategy:

1. Perform detailed biomass feasibility studies for schools, other sites, and communities identified in the previous year, and seek funding and bid out the final design and installation. This would include detailed assessment of the sustainable fuel supply for each potential project.

2. Ensure support for these projects by working with schools, site owners, and community members.

3. Work with state and local officials to ensure a legislative and policy structure supportive of community-scale biomass projects in New Hampshire generally, and Coos County specifically.

4. Refine creative financing mechanisms to create a model capitalization fund that can leverage other funding sources—such as state aid to education funds—to ensure that projects are implemented.
III. METHODOLOGY

TASK 1
Detailed Biomass Feasibility Studies

BERC collected the following information from the facilities:

- Master site plan with listing and identification of all existing buildings by function and square footage
- Heating requirements on hourly, weekly, monthly, and yearly bases as available, with consumption of heating fuel (oil) used by all of the existing buildings
- Present heating system details
- Present fuel used with average current fuel price and onsite fuel storage capabilities
- Expansion plans
- Existing air emissions permit details
- Restrictions likely to have bearing on the heating system

Sites were visited to gain additional information and confirm logistics.

Life-cycle costs were analyzed and specific conclusions and recommendations were given for each site.

TASK 2
Ensure Community Support

BERC convened several meetings in Coos County and attended several more relating to proposed biomass projects in the county and the benefits of biomass heating. BERC worked with partners to set up public outreach meetings and tours of biomass systems.

TASK 3
Policy Initiatives

Throughout the grant period, BERC initiated and furthered a statewide program promoting the use of biomass fuels in New Hampshire schools. BERC staff attended several meetings and helped draft both informational and educational materials as well as proposals and requests for proposals (RFPs) for program development.

TASK 4
Creative Financing Mechanisms

In conjunction with other organizations, BERC has been developing a model nonprofit energy services company (NESCO) that would help finance biomass and other renewable energy projects that are not suitable matches for commercial financing.

Replacing fossil fuel heating systems with biomass in facilities such as schools, hospitals, and other institutions is a direct means to achieving the goals of the North Country Forest Energy Project.
IV. MAJOR ACCOMPLISHMENTS

OVERVIEW

Biomass heating systems use modern equipment to deliver space heat through a building’s existing heat distribution system. Replacing fossil fuel heating systems with biomass in facilities such as schools, hospitals, and other institutions is a direct means to achieving the goals of the North Country Forest Energy Project. Perhaps the most compelling reason for a facility to decide on biomass heating is that the cost of biomass fuel is always much less than the cost of fossil fuels on a Btu basis. Figure 1 on page 11 compares the cost of heating with fossil fuels and woodchips.

FEASIBILITY STUDIES

In the second year of this project, three feasibility studies were completed for schools in Coos County, with an additional four scheduled to be completed in 2009. The potential for community district heating has been studied for Berlin, Groveton, and Lancaster.

The reports summarize the following findings:

- Description of the facility, heating system, and fuel cost
- Review of the present and future heating requirements of the buildings
- Review of the details of the fuels used for heating
- Review of the capacities and locations of existing heating plants
- Site assessment
- Conceptual design of a central biomass heating plant, including plant location, building construction needs, biomass storage, and material handling
- Capital cost estimates for installing a biomass heating system
- Estimates of the amount of biomass fuel required for heating
- Review of the availability, reliability, and price stability of biomass fuel and a listing of potential suppliers
- A life-cycle cost analysis showing estimated costs and project savings over the 30-year life of the equipment compared to the cost of a fossil fuel system
- Recommendations for next steps that facility owners can take to pursue the biomass concept further

The reports also include information on the economic and environmental benefits of biomass heating, the recommended heating technology, and biomass emissions and emissions-control technologies.

BERC completed fuel supply assessments for each site, including characteristics and availability. The regional assessment of a locally available fuel supply remains consistent with the detailed regional assessment completed in the project’s year-one activities, and each site received a specific local assessment.

District officials received the feasibility studies in the fall of 2008 and were favorably impressed with the economics and overall feasibility of installing biomass heating systems in the schools. School officials are currently in discussion with vendors about purchasing a biomass system.

Completed Feasibility Studies

Feasibility studies have been completed for:

- Lancaster Elementary School
- Whitefield Elementary School
- White Mountains Regional High School

Key inputs and findings of each of the completed studies are summarized on the following page. Full reports and economic analyses are included as separate documents with this report.

Perhaps the most compelling reason for a facility to decide on biomass heating is that the cost of biomass fuel is always much less than the cost of fossil fuels on a Btu basis.
## MAJOR ACCOMPLISHMENTS / COMPLETED FEASIBILITY STUDIES

### LANCASTER ELEMENTARY SCHOOL

#### SITE INFORMATION

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>52,000 square feet</td>
</tr>
<tr>
<td>Current fuel type</td>
<td>No. 2 heating oil</td>
</tr>
<tr>
<td>Current annual consumption</td>
<td>26,716 gallons per year average</td>
</tr>
<tr>
<td>System recommendation</td>
<td>2.0 MMBH fully automated woodchip boiler</td>
</tr>
<tr>
<td>Projected wood fuel consumption</td>
<td>404 tons per year</td>
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#### CAPITAL COST OF BIOMASS PROJECT

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood system</td>
<td>$315,000</td>
</tr>
<tr>
<td>Stack</td>
<td>$40,000</td>
</tr>
<tr>
<td>System controls</td>
<td>$15,000</td>
</tr>
<tr>
<td>Electrical connections</td>
<td>$15,000</td>
</tr>
<tr>
<td>Interconnection</td>
<td>$30,000</td>
</tr>
<tr>
<td>Cyclone</td>
<td>$10,000</td>
</tr>
<tr>
<td>Baghouse</td>
<td>$50,000</td>
</tr>
<tr>
<td>Building ($150/SF)</td>
<td>$270,000</td>
</tr>
<tr>
<td>Total capital</td>
<td>$745,000</td>
</tr>
<tr>
<td>General contractor markup 15%</td>
<td>$111,750</td>
</tr>
<tr>
<td>Design 10%</td>
<td>$74,500</td>
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<tr>
<td><strong>Grand total</strong></td>
<td><strong>$931,250</strong></td>
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#### KEY FINDINGS

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<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<td>Total 30-year cost, fossil fuel system</td>
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<td>Total 30-year cost, wood system</td>
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<td>Difference (30-year Net Present Value of savings)</td>
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<td>Calculated carbon offset</td>
<td>37 tons per year</td>
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MAJOR ACCOMPLISHMENTS / COMPLETED FEASIBILITY STUDIES

WHITEFIELD ELEMENTARY SCHOOL

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<th>SITE INFORMATION</th>
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</thead>
<tbody>
<tr>
<td>Area</td>
</tr>
<tr>
<td>Current fuel type</td>
</tr>
<tr>
<td>Current annual consumption</td>
</tr>
<tr>
<td>System recommendation</td>
</tr>
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<td>Projected wood fuel consumption</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CAPITAL COST OF BIOMASS PROJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler</td>
</tr>
<tr>
<td>Stack</td>
</tr>
<tr>
<td>Silo</td>
</tr>
<tr>
<td>Ash removal</td>
</tr>
<tr>
<td>Installation</td>
</tr>
<tr>
<td>Emissions controls</td>
</tr>
<tr>
<td>Building ($150/SF)</td>
</tr>
<tr>
<td>Excavation &amp; buried piping</td>
</tr>
<tr>
<td>Total capital</td>
</tr>
<tr>
<td>General contractor markup 15%</td>
</tr>
<tr>
<td>Design 10%</td>
</tr>
<tr>
<td>Grand total</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>KEY FINDINGS</th>
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<tbody>
<tr>
<td>First year fuel cost savings</td>
</tr>
<tr>
<td>Fuel cost savings over 30 years</td>
</tr>
<tr>
<td>Total 30-year cost, fossil fuel system</td>
</tr>
<tr>
<td>Total 30-year cost, wood system</td>
</tr>
<tr>
<td>Difference (30-year Net Present Value of savings)</td>
</tr>
<tr>
<td>Calculated carbon offset</td>
</tr>
</tbody>
</table>
### WHITE MOUNTAINS REGIONAL HIGH SCHOOL

#### SITE INFORMATION

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<th>Area</th>
<th>109,000 square feet</th>
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<tr>
<td>Current fuel type</td>
<td>No. 2 heating oil</td>
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<tr>
<td>Current annual consumption</td>
<td>26,841 gallons per year average</td>
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<tr>
<td>System recommendation</td>
<td>2.0 MMBH fully automated woodchip boiler</td>
</tr>
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<td>Projected wood fuel consumption</td>
<td>406 tons per year</td>
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#### CAPITAL COST OF BIOMASS PROJECT

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<th>Cost</th>
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<td>Cyclone</td>
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<tr>
<td>Baghouse</td>
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<tr>
<th>Description</th>
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<td>First year fuel cost savings</td>
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<tr>
<td>Fuel cost savings over 30 years</td>
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<tr>
<td>Total 30-year cost, fossil fuel system</td>
<td>$2,683,660</td>
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<tr>
<td>Total 30-year cost, wood system</td>
<td>$1,981,715</td>
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<tr>
<td>Difference (30-year Net Present Value of savings)</td>
<td>$701,944</td>
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<tr>
<td>Calculated carbon offset</td>
<td>37 tons per year</td>
</tr>
</tbody>
</table>
Feasibility Studies in Progress

Feasibility studies with a similar scope of work are being conducted at the following four additional sites in Coos County.

White Mountains Community College
A study is under way for the White Mountains Community College (WMCC) in Berlin. In addition to positive economics and good logistics for a project, WMCC has community resources that make it an excellent prospect for biomass heating, including staff connections to the International Wood Fuels mechanism discussed in the financing section, and a demonstration gasifier technology system. Data collection and analysis is nearly finished and the report will be completed in the spring of 2009.

Androscoggin Valley Hospital
Androscoggin Valley Hospital is working with BERC to complete a feasibility study considering biomass cooling and combined heat and power (CHP). The hospital is also interested in a variety of fuel sources, including woodchips, landfill gas, and coal. The study is anticipated to be completed in the summer of 2009.

Colebrook Recreation Center
The Colebrook Recreation Center presents a good opportunity, despite its small footprint, because of the additional energy load required to heat its indoor pools. Data collection and analysis are underway and the study will be completed in the spring of 2009.

Colebrook Elementary School
Colebrook Elementary School is one of the larger elementary schools in Coos County, and, as such, might be an excellent candidate for woodchip heating. As with the above Colebrook Recreation Center, the study will be completed in the spring of 2009.
MAJOR ACCOMPLISHMENTS / DISTRICT HEATING

DISTRICT HEATING

District energy systems use one or more central plants to provide thermal energy to multiple buildings. This approach replaces the need for individual, building-based boilers, furnaces, and cooling systems. Underground pipelines from the heating (or cooling) plant distribute thermal energy to each of the connected buildings in the form of hot water, steam, or chilled water. Energy is then extracted at the buildings and the water is brought back to the plant, through return pipes, to be heated or cooled again.

District heating systems can provide space heating and domestic hot water for large office buildings, schools, college campuses, hotels, hospitals, apartment complexes, and other municipal, institutional, and commercial buildings. Systems can also be used to heat neighborhoods and single-family residences.

Municipalities can incorporate district energy into the infrastructure of their downtown business districts or encourage its use in such new developments as office building complexes and industrial parks. When local biomass fuels, such as woodchips, are used instead of oil or gas, the benefits of renewable energy can be brought to many buildings.

Biomass fueled district heating helps communities by taking advantage of economies of scale to reduce heating costs to individual consumers, keeping energy dollars in the local community and supporting local industry. It improves air quality by replacing individual systems that have limited or no emissions controls with a centralized heating plant with advanced air-quality control technology. Perhaps the greatest benefit is dollar savings: At an oil price of $3 per gallon and a wood fuel price of $55 per ton, biomass fuel is 69 percent less expensive than oil per Btu.

FIGURE 1:
Fuel Type Comparison Chart

<table>
<thead>
<tr>
<th>FUEL TYPE</th>
<th>UNIT</th>
<th>COST/ UNIT</th>
<th>BTU/ UNIT (DRY)</th>
<th>MOISTURE CONTENT</th>
<th>MMBTU/ UNIT (WET)</th>
<th>COST OF MMBTU DELIVERED</th>
<th>AVERAGE SEASONAL EFFICIENCY</th>
<th>MMBTU/ UNIT AFTER COMBUSTION</th>
<th>COST/ MMBTU AFTER COMBUSTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATURAL GAS</td>
<td>decatherm</td>
<td>$10</td>
<td>1,000,000</td>
<td>0%</td>
<td>1,000</td>
<td>$10</td>
<td>80%</td>
<td>0.800</td>
<td>$12.50</td>
</tr>
<tr>
<td>OIL</td>
<td>gallon</td>
<td>$3</td>
<td>138,000</td>
<td>0%</td>
<td>0.138</td>
<td>$21.74</td>
<td>75%</td>
<td>0.104</td>
<td>$28.99</td>
</tr>
<tr>
<td>PROPANE</td>
<td>gallon</td>
<td>$2</td>
<td>92,000</td>
<td>0%</td>
<td>0.092</td>
<td>$21.74</td>
<td>80%</td>
<td>0.074</td>
<td>$27.17</td>
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<tr>
<td>WOODCHIPS</td>
<td>ton</td>
<td>$55</td>
<td>16,500,000</td>
<td>42%</td>
<td>9.570</td>
<td>$5.75</td>
<td>65%</td>
<td>6.22</td>
<td>$8.84</td>
</tr>
<tr>
<td>WOOD PELLETS</td>
<td>ton</td>
<td>$250</td>
<td>16,500,000</td>
<td>6%</td>
<td>15.510</td>
<td>$16.12</td>
<td>80%</td>
<td>12.41</td>
<td>$20.15</td>
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<tr>
<td>CORN</td>
<td>ton</td>
<td>$140</td>
<td>16,500,000</td>
<td>15.5%</td>
<td>13.943</td>
<td>$10.04</td>
<td>75%</td>
<td>10.46</td>
<td>$13.39</td>
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</table>
In the previous year, BERC identified the three communities in Coos County with the highest potential for district heating as Berlin, Groveton, and Lancaster. Progress has been made in each of these communities as described in the following sections.

**Berlin**

Berlin has some of the larger schools and facilities in Coos County suitable for serving as anchor loads. Anchor loads are buildings with substantial heat demand that often drive the economics of a district energy project. The community also has a compact business district, which is ideal for minimizing overall underground piping distance as well as the additional benefit of melting snow on sidewalks.

BERC presented the benefits of a district heating system to Berlin’s mayor and other city officials and detailed its potential for Berlin. Currently, fuel consumption data is being collected for the downtown area and possible plant sites are being evaluated.

The main business district of the town lies within the intersections of Main and Pleasant Streets. The buildings within this crescent and on either side of both streets have a combined total area of approximately 922,000 square feet. Most of the buildings are heated with oil with the exception of a few heated by propane. In the Northeast region, the average annual oil consumption is 0.46 gallons per square foot. The business district can be estimated to use the equivalent of 424,000 gallons of heating oil per year.

Two of the city’s larger anchor loads are the high school and the middle school complex. These are somewhat removed from the downtown area. Running distribution piping to these facilities—with the option of providing heat to the buildings on that route—would add another 422,000 square feet of heating potential to the project. The buildings along this route are largely residential and heated almost entirely with oil, with some propane and wood use. They are estimated to use the equivalent of 194,000 gallons of oil annually.

Two of the biggest challenges to moving ahead with district energy in Berlin are plant siting and an ownership structure.

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**FIGURE 2:** Proposed Distribution Networks in Berlin
One proposed site is the closed paper mill in the middle of town, across the river from the business district. Much of this area has already been cleared, and public sentiment is leaning against industrial or power plant development in such a highly visible part of town; residents wish to see this land used in more aesthetic ways. Another site that might draw more public approval is beyond the high school, which could well serve the additional residential area outlined above. While this represents a good project site, the land may not be available for purchase.

Ownership and operation of the heating plant itself presents challenges. While there is potential for savings, the capital investment in installing a project is high and the owner is put in the position of becoming a utility provider. Although there are many models of municipally owned and operated utilities—including electricity, water, sewer, and trash removal—not all municipalities want to take on that role. Fortunately, the City of Berlin is interested in further exploring the municipal utility option of biomass district heating.

An alternative for district energy and plant ownership would be for the city, a third party, or individual consumers to purchase waste heat from a proposed power plant that is scheduled to be constructed and commissioned in 2010 on the current Burgess Mill site. The plant developers plan to provide power and much of its waste heat to the Fraser Paper Mill in nearby Gorham. They have expressed interest in selling additional heat produced in the process of electrical production to a third-party utility or the city for distribution to individual consumers, but are less interested in serving as the thermal utility themselves. At this point, data is too preliminary to determine the quantity of potentially available thermal energy and the price per Btu of that energy. This source of low-cost heat could lend inertia to the project and prompt the installation of the distribution network. Once residents see the benefits of the system in action, it may be easier to site a central heating plant in the town to expand the district energy system.

BERC will continue to work with officials in the City of Berlin to explore and promote the possibility of district heat for this community by collecting additional detailed heating information for the community (rather than relying on estimates), and working with city officials on siting issues and the development of a business model. A final feasibility report will be delivered to the city when the study concludes.

**Groveton**

In the previous year, Groveton was identified as one of the most promising communities in Coos County for district heating. Interest and discussion began when a power plant was proposed on the outskirts of town and a full district heating study for Groveton was conducted by Horizons Engineering, LLC and the Ramboll Denmark A/S.

The original concept was to study district heating using waste heat from the power plant. At this point, the power plant does not appear likely to be constructed in the near future; therefore the study examined the option of constructing a heating plant on the Wausau Paper Mill site located near the town center and distributing heat from there. This source of energy would be more expensive than purchasing waste heat from a power plant, but still realize savings for the consumers and economic benefits for the community and the region. The study showed positive economics for a centralized thermal biomass plant constructed for the sole purpose of heating the town, however, did not consider ownership of the plant nor a business model for its operation.

Different distribution system configurations were examined to minimize expenses while maximizing the potential heat load served. The study recommended pursuing one of three positive scenarios for a district heating system. It called for further study, including more detailed data collection and cost estimates for the woodchip heating plant and distribution piping, and the development of a business model for owning and operating a district heating plant.
BERC looks forward to working with Groveton officials, local economic development organizations, and potential developers to continue to refine assumptions, develop a business model for the project, and promote the district energy concept. The ownership structure and financing mechanism remain vital issues to consider.

One demonstrated ownership option is to form a cooperative of consumers that would own the district heating system. The cooperative can apply for financial support from the state or federal government or borrow funds from commercial banks. Equity funds should equal 20 percent of the initial cost of the project. Member consumers and the municipality can contribute to this fund.

**Lancaster**

The City of Lancaster was presented with a district heating concept proposal by Dr. Morris Pierce of Rochester University. He is actively promoting the concept of district energy throughout New Hampshire and Vermont. His concept proposal calls for several heating plants throughout the city, including at the elementary school. The plants would be constructed in phases, with each initially installed to solely heat the host facility, but at a higher capacity than required for that site alone. The plants would eventually be connected by hot water distribution piping to heat buildings along the distribution network. Once the distribution network was completed, a centralized plant could be added for additional capacity or to replace some or all of the individual systems. Dr. Pierce’s proposal does not include a cost benefit analysis or consideration of ownership and operational issues.

This model presents two major challenges. First, public facilities such as schools would be placed in the position of becoming public utilities. Second, over-sized heating equipment would compromise efficiency until additional facilities are connected and the full capacity of each system is utilized.

One of the sites in the proposal is a logging and trucking business that is interested in pursuing biomass heating at its facility with the option of integrating into a district system if other facilities follow suit. School district decision makers are positive about the concept of biomass heating at the school, but it is not clear if they would be interested in sizing the system to distribute heat to surrounding buildings as well.

This model is being widely discussed in Coos County and throughout the Northeast. In the right community with enough interested community partners to serve as anchor facilities, it could present a viable alternative to the high capital investment associated with a centrally owned and operated district heating plant.

Another option is to install a centralized district heating system with a large boiler sized to provide thermal energy for most of the anchor loads in Lancaster. A feasibility study could evaluate this option, including efficiency, cost effectiveness, ownership, and operation. Further study can also include comparison of this option to the one proposed by Dr. Pierce.
Converting buildings and institutions to wood heating can serve as the foundation for a whole new biomass energy industry that will make Coos County a renewable energy model for the rest of the state and for the nation. There is no doubt that stimulating the development of the first few successful wood energy conversion projects can serve as demonstrations and models to inspire other public entities and building owners. This incremental approach will take time to grow to a level of providing significant impact and benefit for Coos County. An alternate, more aggressive approach is to set up programs designed to identify and overcome barriers to widespread implementation.

There is growing recognition of the need to develop such an aggressive program. A programmatic approach will stimulate the conversion of more buildings, create a powerful critical mass of successful installations, and provide significant societal benefits within a faster time frame. BERC has been working closely with partners in the State of New Hampshire to develop a community-scale biomass heating program.

V. A NEW HAMPSHIRE FUELS FOR SCHOOLS PROGRAM

PROGRAM OPPORTUNITIES
Converting buildings and institutions to wood heating can serve as the foundation for an entire new biomass energy industry that will make Coos County a renewable energy model for the rest of the state and for the nation. There is no doubt that stimulating the development of the first few successful wood energy conversion projects can serve as demonstrations and models to inspire other public entities and building owners. This incremental approach will take time to grow to a level of providing significant impact and benefit for Coos County. An alternate, more aggressive approach is to set up programs designed to identify and overcome barriers to widespread implementation.

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NEW HAMPSHIRE COMMUNITY-SCALE BIOMASS HEATING PROGRAM
Since 2005, BERC has been developing this program concept and strengthening the effort through the North Country Forest Energy Project.

BERC engaged stakeholders at key meetings over the last year and helped to organize participants focused primarily on schools and other institutional buildings. It worked closely with the North Country RC&D, which subsequently formed a program advisory group of which BERC is a member. The “Fuels For Schools” concept was found to be too limiting, so the advisory group renamed and refocused the program as the “New Hampshire Community-Scale Biomass Heating Program” (NHCSBH). The program will extend beyond the scope of the Fuels For Schools concept to cover not only schools, but also universities and other state buildings interested in converting to biomass heating. The goal of the program is to promote and encourage the use of low-grade wood residues from the forest products industry and direct forest harvesting as a locally available renewable energy source for heating and powering schools, universities, and other public and community-scale facilities.

The NHCSBH is a partnership of federal, state, and private agencies for promoting the use of biomass heating systems in municipal, county, and school buildings throughout the state. This program is being designed to coordinate the efforts of all partners to install cost-effective biomass heating systems and can provide a comprehensive set of biomass fuel options and resources for Coos County and the State of New Hampshire.
COMMUNITY-SCALE BIOMASS HEATING PROGRAM OBJECTIVES

BERC has articulated and proposed the following objectives for the NHCSBH Program:

- To install cost-effective, successful biomass heating systems
- To further develop prospects for alternate biomass system and fuel options, including semi-automated, pellet, and corn systems
- To assess, report on, and develop the biomass fuel supply market
- To increase vendor competition and raise the bar on technology development
- To collect and manage data on biomass heating systems in New Hampshire schools, university campuses and other state, public, institutional, and commercial facilities
- To educate the public on the benefits of heating with woodchips and pellets

The group secured funding under the “Jump Start” program of the US Forest Service. The Wood Biomass Jump Start Grant has come to a close having completed biomass conversion feasibility studies at five schools, two county complexes, one university campus, and one new state building. In addition, four tours and three workshops introduced more than 140 municipal, school, and county officials to the potential of biomass heating.

Another group emerged out of the Groveton District Heating Feasibility Study and now includes several other North Country communities. After completing the feasibility study in Groveton, a number of other communities including Berlin, Colebrook, Gorham, Errol, Winchester, and the Mt. Washington Resort have shown interest in district heating solutions. A visit to New Hampshire by the Danish Board of District Heating in November 2008 created a great deal of interest in district heating systems in communities of Coos County as well as other adjacent New Hampshire counties.

Both of these initiatives have active advisory teams that have now been merged. This combined initiative, targeting both institutional and community-scale biomass heating along with CHP where appropriate and other renewable fuels, is searching for resources to continue the progress made so far. Close to 70 people from communities, schools, technical and financial assistance agencies and organizations, related industries, and political offices are now part of this growing network. The new combined group has been named the New Hampshire District/Biomass Task Force (NHD/BTF). Its mission is to investigate and promote community-scale district heating and biomass energy systems in order to maintain healthy forests and grow local communities.

Lessons learned by four significant activities conducted during 2008—the Community-Scale Wood Biomass Project, the Groveton Distributed Energy and District Heating Feasibility Study, the Energy Component of the Coos County Economic Action Plan, and the formation of the New Hampshire Wood Biomass Heat and Power Task Force—have resulted in identifying five critical areas to research and present to communities and organizations as a “roadmap” to pursuing district heating and power opportunities:

- Technology/Equipment and Suppliers
- Systems Installation/Operation and Management
- Funding Opportunities
- Air Quality Regulations and Benefits
- Public Policy and Regulations

The task force drafted a proposal around these five areas to the New Hampshire Greenhouse Gas Emissions Fund. It requests support in preparing this roadmap that will assist in positioning communities to explore and implement district heating and CHP options using renewable carbon-neutral woody biomass.
A NEW HAMPSHIRE FUELS FOR SCHOOLS PROGRAM (CONT’D)

PROGRAM PARTNERS

The major program partners and members of the advisory group of the New Hampshire Community-Scale Biomass Heating Program are listed below with a brief description of their activities.

The North Country Resource Conservation and Development (RC&D) Area Council. The North Country RC&D Area Council was established to address problems and opportunities in New Hampshire’s “North Country,” encompassing the counties of Belknap, Carroll, Coos, and Grafton. Its mission is to facilitate cooperative action and inspire leadership with people, organizations, and communities for a sustainable economy rooted in the conservation and development of our natural resources.

North Country RC&D convened the advisory group of stakeholders and interested agencies to promote “Fuel For Schools” in the State of New Hampshire as described above. As the program coordinator, North Country RC&D is committed to move this program forward.

New Hampshire Department of Education (NH DOEd). NH DOEd’s mission is “to provide educational leadership and services which promote equal educational opportunities and quality practices and programs that enable New Hampshire residents to become fully productive members of society.”

School Building Aid is a program through which the State of New Hampshire provides financial assistance to local public school districts to construct or substantially renovate K-12 facilities. Each district is entitled to a percentage rate of reimbursement of the cost of construction, land acquisition, planning and design, furniture, fixtures, and equipment. This percentage, between 30 and 60, is based on the number of students and median income of the town. The NH DOEd also provides information and technical advice concerning planning, construction, and maintenance of school facilities. The aid is made available for bond payments and provided based on two specific formulas using the number of towns involved in a cooperative school district or the median family income of the population within the school district.

The NH DOEd is very supportive of the NHCSBH Program, assisting in its development and willing to be the first contact point for interested schools. Other possible points of entry into the program are the New Hampshire School Board Association, the New Hampshire Superintendents Association, and New Hampshire School Administration Association.

New Hampshire Partnership for High Performance Schools (PHPS), Jordan Institute. Founded in 1995, PHPS is an initiative of the Jordan Institute. It is a science-based, non-advocacy, nonprofit that develops initiatives focusing on the intersection of a healthy environment, healthy people, and a healthy economy. It works in partnership with the Henry P. Kendall Foundation, Public Service of New Hampshire, the New Hampshire Office of Energy and Planning, the New Hampshire Department of Education, and the New Hampshire Department of Administrative Services to increase the number of high performance schools constructed in the state. The Jordan Institute, through PHPS, has helped develop the NHCSBH Program by promoting the installation of biomass heating systems in schools, to date, working with more than 15 schools.

The Jordan Institute pre-qualified BERC as a provider of energy-related services to help carry out a multi-year program of making comprehensive energy efficiency and onsite clean energy improvements in public- and private-sector buildings throughout the state. The new program, Granite State Energy Efficiency (GSE2), will arrange financing and provide comprehensive planning, technical, and project management assistance to help building owners achieve deep and lasting improvements in energy performance. The Institute’s goals are to save energy, avoid greenhouse gas emissions, reduce costs, and improve building performance. The development of GSE2 is supported by a major grant from the US Department of Energy and New Hampshire Office of Energy and Planning and by support from the US Environmental Protection Agency and other agencies, foundations, and individuals. In 2008-2009, GSE2 is concentrating on school and municipal buildings and on special opportunities in the commercial, industrial, institutional, and residential sectors.
GSE2 objectives for school buildings are to enable school districts to achieve Energy Star status for virtually all of New Hampshire’s 450 school buildings, to ensure that all cost-effective efficiency and onsite clean energy improvements are made, and thereby to exceed Energy Star standards by a significant amount in most buildings. The Jordan Institute works closely with the state Department of Education, electric and gas utilities, and other partners.

Division of Air Resources, New Hampshire Department of Environmental Services. The mission of the division is “to achieve the maximum reductions in emissions of pollutants that pose the greatest risk to public health and the environment, as quickly as possible, and as cost effectively as possible.” The Air Resources Division, with guidance from the New Hampshire Air Resources Council, is committed to promoting cost-effective, sensible strategies and control measures to address today’s complex and interrelated air-quality issues, including, but not limited to, ground-level ozone, particulate matter, regional haze (visibility), mercury emissions, increasing concentrations of greenhouse gases, acid deposition, and air toxics.

University of New Hampshire (UNH) Cooperative Extension. UNH Cooperative Extension provides New Hampshire citizens with research-based education and information, enhancing their ability to make informed decisions that strengthen youth, families, and communities, sustain natural resources, and improve the economy. UNH Cooperative Extension is a partnership of public, private, and community resources that strengthens communities through a Community Profile process involving local citizens in identifying community issues and creating strategies for working together to address them.

New England Wood Pellet (NEWP). NEWP, a pellet fuel manufacturer and distributor, provides wood pellets, contributing to reducing the nation’s overdependence on fossil energy. The NEWP Jaffrey plant in southeastern New Hampshire produces approximately 75,000 tons per year of premium- and standard-grade wood pellets. Most is bagged and shipped to retailers throughout the northeast, but it also services larger pellet users through bulk delivery by truck.

The plant purchases nearly 175,000 dry and green tons of wood residues each year from sources throughout the Northeast, providing a valuable market for wood waste and low-grade timber resources.

Other members of the advisory group are the:
- New Hampshire Office of Energy and Planning
- New Hampshire Division of Forests and Lands
- New Hampshire Sustainable Energy Association
- US Department of Energy
- Public Service of New Hampshire
- Northeast Regional Biomass Program
- New Hampshire Timberland Owners Association
- Center for Rural Partnerships, Plymouth State University
- New Hampshire Local Government Center

NH DOEd and the Office of Energy and Planning have been identified as the best points of contact for interested schools and communities. It was also suggested that the New Hampshire Local Government Center might be an alternative as well as the previously listed organizations that serve the school administration community.

Meetings of the NHCSBH Advisory Group

The advisory group held its first meeting on November 1, 2005. During that year, BERC was invited to provide information and become part of the group and has been an active member throughout, attending and participating in eight meetings in the last 12 months and helping to structure the program and provide promotional materials.
DEMONSTRATION PROJECTS

One of the first objectives of the NHCSB Program will be to implement and showcase demonstration projects. Real, effective assistance to communities in addressing the potential for using local wood for heating buildings cannot be met without on-the-ground project development and the creation of programmatic structures to support project activities over the long term. Wood heating projects in public schools in Coos County need to be advanced to the implementation phase.

It is critically important that initial projects are successful. Under the NHCSBH Program, these demonstration projects will be provided with:

- Analysis of the appropriateness and cost-effectiveness of wood heating
- Assistance in setting up, designing, and implementing projects
- Wood fuel specifications and help in soliciting bids from fuel suppliers
- Wood fuel procurement strategies and contract provisions to strengthen relationships with fuel suppliers
- Commissioning, testing, and monitoring services during the first year of wood system operation
- Monitoring activities that allow the program partners to collect data on newly constructed systems to improve projects and the program itself in the future

These projects will serve as examples to schools and facilities that may wish to convert in the future, and commissioning reports are an excellent way to disseminate information on projects as well as document success of this program to state and federal agencies.

The need for a demonstration project in northern New Hampshire was clear in BERC’s work during the second year of activities. While some facility decision makers were favorable about biomass and pleased to participate in a feasibility study, others were skeptical about the benefits of a biomass system. A successful system in the state that can demonstrate the ease of operation of the system, the clean burning modern technologies, and actual economic benefits to the facility will be a critical element in promoting biomass heating in the region.

Feasibility Studies

As a first step in getting a demonstration project on the ground, feasibility studies were conducted over the last 12 months for five schools, two county complexes, one university campus, and one new state building under the Jump Start program funded by the US Department of Agriculture (in addition to those conducted in the North Country Forest Energy Project). BERC conducted two of the studies.

In order to maximize participation in the Jump Start program, Coos County schools were invited to receive feasibility studies from BERC through support from the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation rather than applying for Jump Start funding. While none of the facilities funded under the Jump Start Program were in Coos County, the nearby Grafton County complex in Haverhill, New Hampshire participated in the study. This resulted in positive findings, and county officials are proceeding with a biomass project. They hope to secure funding and begin construction in 2009 with the heating system operational in 2010. The project could serve as a demonstration project for the area and increase knowledge about, and interest in, biomass heating in Coos County.
VI. CREATIVE FINANCING FOR WOOD HEATING SYSTEMS

In year one of the North Country Forest Energy Project, financing was identified as a challenge to getting wood heating projects built. While there are substantial fuel cost savings, the capital cost of such systems is significantly higher than fossil fuel systems and the payback period for these projects tends to be too long to be financed by existing commercial financing mechanisms. BERC identified financing mechanisms that exist—or that could be developed—to fill this need. In this second year, BERC refined and promoted these mechanisms.

OWNERSHIP AND FINANCING OPTIONS

There are a variety of ownership and financing mechanisms that can be used to pay the initial costs of converting school heating systems to wood fuel or other alternative fuels. Potential owners of these systems can be the school district, the state, or a third-party provider. The third-party provider could be a consortium of school districts, a local owner/operator, the provider of the capital, or an independent energy services company (ESCO). If the district opts to own the system, financing options include debt, leasing, or outright purchase. The source of the funds could be bond proceeds, state funds, local funds, bank debt, a lease, or private or charitable capital. If a third-party provider owns the system, the school district would enter into a long-term agreement to purchase the system’s thermal output. The third-party provider would be responsible for financing, installing, and operating the energy system, possibly under contract with local providers. Capital sources available to third-party providers include bank debt, leasing, bond proceeds (especially if the owner is a public body or utility), and private or charitable capital. Incentives and tax credits may also be part of the financing. An agreement would detail the school district’s payment stream, which could be based upon shared savings, guaranteed savings, or simply a fee for use.

Figure 3 below outlines a variety of options that could be available to facilities for owning and financing energy conversions and enhancements. As the table indicates, certain innovative approaches are not mutually exclusive. For example, a consortium of school districts could be created to manage the construction and installation and take advantage of any type of financing. Alternately, any type of owner could offer to sell heat. Specific financing opportunities are further detailed in the following pages, including the advantages and disadvantages of the models.

FIGURE 3:
New Hampshire Renewable Heat Ownership and Financing Options

<table>
<thead>
<tr>
<th>WHO WILL OWN IT?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner is responsible for securing financing, installing, and day-to-day management (any of these can be subcontracted)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PUBLIC ENTITY</th>
<th>3RD-PARTY PROVIDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local school district</td>
<td>Local operator</td>
</tr>
<tr>
<td>State of New Hampshire</td>
<td>Capital provider</td>
</tr>
<tr>
<td>Consortium of multiple school districts</td>
<td>ESCO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCES OF CAPITAL FOR PUBLIC ENTITIES</th>
<th>SOURCES OF CAPITAL FOR PUBLIC ENTITY OR 3RD-PARTY PROVIDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualified energy conservation bonds</td>
<td>Bank debt</td>
</tr>
<tr>
<td>Municipal or state bonds - general obligation or revenue</td>
<td>Leasing company</td>
</tr>
<tr>
<td>Municipal lease</td>
<td>Private or charitable capital - equity</td>
</tr>
</tbody>
</table>
STATE AND REGIONAL PROGRAMS AND INCENTIVES

State Policy Preference for Biomass or Geothermal

State policy could offer an incentive for the installation of wood-fueled or other systems such as geothermal by providing a higher subsidy and faster-track approval for these systems. Systems that meet certain criteria might even be pre-approved and allowed to proceed through a quicker state approval process.

Examples. Vermont provides local communities with an outright grant for school construction costs rather than a payment for debt service as is the case in New Hampshire. For a period of time, Vermont increased the state school construction subsidy from 50 percent for most fuel systems to 90 percent for biomass systems. This was a critical element in the success of Vermont’s Fuels For Schools program.

Advantages. These programs are easy for decision makers to understand and participate in and do not require new infrastructure or the creation of new funds.

Disadvantages. If the subsidy level is too high, it may end up facilitating the installation of projects that would not otherwise be financially successful (where the fuel savings over time are not enough to offset the project’s costs).

Municipal Bonds

Communities that want to convert to wood systems could secure approval from the commissioner (or even be allowed a pre-approved fast-track system), approve a funding referendum, and work with the New Hampshire Municipal Bond Bank to obtain the required funds.

Examples. Vermont schools have used municipal bonds to install wood fuel systems. In Vermont, the state reimburses 30 percent of the construction (subject to funds availability) rather than debt repayment.

Advantages. Communities could move more quickly on their own.

Disadvantages. This model depends strongly on public opinion and requires strong advocates in the community. It also leaves communities on their own, where as other models promote partnership with experienced partners in wood-energy systems.

Municipal Lease

Leasing, or an installment purchase program, offers an alternative to traditional financing. Typically, the leasing company will make the capital investment in the purchase and installation of the equipment. The facility then leases the equipment and assumes responsibility of project operation and maintenance. The lease is repaid using the savings generated by the energy project.

Leasing is often attractive since it can provide a financing mechanism that does not require a bond vote since it is not considered “debt.”

Examples. Municipal leasing has been used to finance energy performance contracts in communities across northern New England, including a school energy project in Farmingham, Maine.

Advantages. This model provides 100 percent financing to be paid out of energy savings.

Disadvantages. While used successfully for other types of municipal projects, energy systems are currently not funded by this mechanism. It may require a good deal of time and effort on the part of the facility and the municipality to find a leasing company for this type of funding.

New Markets Tax Credits

This program began in 2003 focusing on rural areas of New England and New York. It provides a 39 percent federal income tax credit for projects in eligible, low-income areas classified as disadvantaged in the federal census.

Advantages. The program draws capital into underserved areas and communities. It has flexible payout options that can be structured to the best advantage of the facility and/or investors.

Disadvantages. All locations must be checked against census maps for disadvantaged areas. It is very site specific, with some sites being eligible while directly adjacent sites are not. This program is only available to facilities or investors paying federal income tax, so it may have limited applications in schools and other public entities.
CREATIVE FINANCING FOR WOOD HEATING SYSTEMS (CONT’D)

FEDERAL INCENTIVES

Qualified Energy Conservation Bonds (QECBs)

The federal bank bailout legislation passed in the fall of 2008 includes a new category of tax credit bonds called Qualified Energy Conservation Bonds (QECBs). The IRS has not yet issued formal program guidance nor published the state-by-state allocation of the $800 million volume cap.

These bonds have been structured like Clean Renewable Energy Bonds (CREBs) and are therefore expected to perform as a no-interest bond for the end user. The bondholder will receive federal tax credits in lieu of traditional interest. QECBs can support a variety of energy conservation purposes, including capital expenditures for reducing energy consumption by 20 percent in publicly owned buildings and demonstration projects designed to promote the commercialization of “conversion of agricultural waste for use in the production of fuel.”

It is unclear if these bonds would be available to a third-party owner/operator option or if they would only be available to facility-owned and operated energy projects.

Advantages. These bonds could provide a low-cost means of securing funding and could be targeted specifically to schools or public buildings by the State of New Hampshire to provide funds for the NHCSBH Program.

Disadvantages. As a new initiative, bond buyers and finance professionals are not yet familiar with the program and there will be a learning curve for these parties with the requirements for these bonds. The program is still in development and may not be available immediately. When funds do become available, there will likely be a limited window of opportunity for participation in the program, and schools and other projects with public benefits will be competing with may other eligible projects.

OTHER FINANCING POSSIBILITIES

Vendor Leasing

Vendors installing a turnkey wood-fuel system could work with a leasing company to provide financing to the school district. This allows the vendor to receive cash for the sale and the buyer to obtain financing. From the school district or facility owner’s perspective, vendor leasing would perform similarly to municipal leasing, but may cost more.

Advantages. Communities could move quickly on their own, with greatly reduced risk.

Disadvantages. This model is likely to cost more than municipal debt, and may not allow for competitive bidding and selection of the best technology for the site. While used successfully in other types of energy projects, none of the current wood-system vendors have engaged in this type of agreement.

ESCO Performance Contracts

Energy services companies (ESCO) enter into agreements with facility owners to secure energy savings. Typically, the ESCO investigates and proposes potential energy saving measures and improvements, secures financing for the capital costs of the improvements (and the ESCO’s associated expenses, including profit), and oversees construction and installation. They then recover their investment from a portion of the savings from the reduced energy costs. ESCOs make use of performance-based contracts to assure mutual benefits to both parties.

Currently, there are about a dozen for-profit ESCO firms available to customers in New Hampshire (see http://www.energyservicescoalition.org/members/default.aspx). The primary ESCOs operating in the state are Honeywell and Siemens. Most ESCOs are divisions of fairly large companies and many have little, if any, familiarity with wood-heating technologies.
CREATIVE FINANCING FOR WOOD HEATING SYSTEMS (CONT’D)

Although some nonprofit or cooperative energy and efficiency companies have provided ESCO-type services at some point in their history, we are not aware of any municipal consortium, cooperative, or nonprofit currently providing ESCO services in North America. The scope of New Hampshire’s interest in converting schools to renewable heat could propel sufficient demand for this type of cooperative or nonprofit ESCO.

Advantages. ESCO projects are likely to encourage energy efficiency measures in tandem with heating system replacements, further maximizing the client’s savings. Savings are assured and the burden of capital financing and commissioning are assumed by the ESCO rather than the school district or facility owner.

Disadvantages. ESCO financing creates a number of liability issues that need to be resolved on a contract-specific basis. These projects may not be eligible for some state or federal subsidies. There are also concerns with the ESCO model regarding local control of the project. Some ESCOs operate on similar financial metrics to commercial financing and find the payback periods for smaller wood projects too long to be an attractive option.

Sale of Heat – Purchase Heat Agreement

Purchase power agreements (PPAs) are commonly used in the sale and purchase of electrical energy. Third parties own the energy generator and sell the output to the customer. The customer often provides the site for the installation of the generating system.

The PPA provider is responsible for financing, installing, operating, and maintaining the generating system, and may contract with others to provide some of these services. The typical PPA model works as shown in Figure 4 at the bottom of this page.

A purchase heat agreement would follow the same approach but be for the sale of heat rather than power. A third-party entity would enter into a site lease agreement with the school district or facility owner, and then purchase, install, operate, maintain, and own the heating system. This entity would then sell the output—heat—to the school district or facility. Pricing would be based on a cost-plus charge or a fee per Btu provided.

FIGURE 4:
How a Power Purchase Agreement (PPA) Works
CREATIVE FINANCING FOR WOOD HEATING SYSTEMS (CONT’D)

The entity selling the heat could be a consortium of school districts, a heating ventilation or air conditioning (HVAC) service provider, an ESCO, the system vendor, or the provider of capital. The provider could also make use of any available tax credits, financing incentives, or environmental benefits that might not be available to a public entity like a school district.

Examples. MMA Renewable Ventures is a capital provider that installs renewable generation and efficiency measures and then owns and operates the renewable generation systems at their customers’ facilities.

An additional example of this model is International Woodfuels (IWF), a start up that is seeking to become active in the North Country. Its first installation is expected to go online in the fall of 2009 at Franklin Pierce University in Rindge, New Hampshire.

IWF would construct and operate pellet heating systems at its client facilities, and sell the facility the heat on a Btu basis. The price of heat would be pegged to the price of oil, so that the client would purchase Btus of heat at a contracted price at a set percentage below the price of oil on a Btu basis. IWF is currently offering contracts at 15 percent below the price of oil.

A member of the White Mountains Community College is a principal in the business and the college is interested in exploring this option for their facility in Berlin, New Hampshire. BERC is helping the college evaluate the advantages and disadvantages of this model as compared to owning and operating a woodchip system.

Advantages. The school district or facility owner has no capital risk in either the purchase, installation, or operation of the system. They are insulated from fluctuations in fuel prices by long-term contracts.

Disadvantages. There would be some risk on the facility’s part about recourse if the system is not sized or operated properly and does not provide adequate heat. As with ESCO contracts, there are liability issues on a site-specific basis and similar concerns about the lack of local control.

FURTHER DEVELOPMENT OF NONPROFIT ENERGY SERVICES COMPANY (NESCO) MODEL

Energy Services Companies (ESCOs) typically identify energy savings in a facility. If significant savings can be identified, the ESCO then executes a performance-based contract with the site owner that commits the ESCO to making the improvements that can deliver energy savings to the facility.

The cost of the improvements, the expected level of savings, and whether or not the customer requires the savings to be guaranteed determine the pricing of a performance contract. Generally, a performance-based contract will result in both near- and long-term savings for a facility.

ESCOs have been particularly successful working with facility managers of government, hospital, and university properties. These facilities often have limited expertise about what measures make the most sense. The combination of an ESCO’s expertise with the expected longevity and public support for the facility made ESCO investments relatively attractive in the pre-meltdown capital markets. A number of ESCOs are divisions of larger companies that sell controls or other energy-related equipment. These larger firms often have the ability to absorb the overhead associated with the long lead times often associated with public-sector projects.

A nonprofit energy services company (NESCO) focused on community-scale wood heating would provide evaluations of existing energy systems, analyses of potential energy savings measures and improvements, definition of system requirements, system design, fuel procurement, assistance in selecting vendors, sourcing and obtaining project capital, oversight of any installation, system commissioning, and savings verification. The expected functions and structure of a NESCO are illustrated in Figure 5 on the following page. While this diagram indicates that the NESCO would secure the financing, the actual collateral would be the equipment installed at the facility and an assignment of the savings.
The facility would continue to own the biomass system and all its components and would most likely be responsible for permitting. System operation could be handled by either the facility or the NESCO.

There are not currently any nonprofit or cooperative ESCOs operating in North America despite significant interest in the concept. The Vermont Energy Investment Corporation (VEIC), the operator of Efficiency Vermont, has, in the past, acted as an ESCO for small-scale affordable housing projects. Studies of the US ESCO industry conducted by Lawrence Livermore Labs have shown an increase in revenues for ESCOs but a decrease in the number of entities operating. Europe has at least one nonprofit company called a cooperative ESCO—these appear to be comparable to community-owned energy ventures in the United States.

**Costs**

As a nonprofit, a NESCO might be able to access grant funds for its start up. While the NESCO would need to cover its costs through fees and grants, it is probable that it would not need to also earn the level of profits required by for-profit ESCOs.

Establishing a NESCO for community-scale wood energy systems would be a significant new undertaking, requiring careful thought and planning. While it may reduce the facility’s technical, performance, and financial risk, there is no inherent assurance that project costs would be less than or even the same as cost under current financing models. If start-up and operating costs could not be obtained from private or government grants, these costs (roughly estimated at about $135,000 to $140,000 per year: see Figure 6) would need to be absorbed by project costs. In order to be cost effective, this level of staffing would be required to support at least 10-12 distinct projects per year.
Achieving nonprofit status as an independent entity—as opposed to operating as a program of an existing nonprofit or government agency—could also be challenging since the provision of energy services is not typically a charitable, scientific or educational purpose. A new nonprofit would also face challenges securing affordable capital, particularly in the current financial environment.

One of the major challenges of operating an ESCO is the potentially long lead times between the ESCO’s first encounter with a potential project and the actual execution of a performance agreement. A NESCO would need to have sufficient funds to cover its operating costs for this initial start-up phase, which could last from four months to in excess of a year.

**Implementation Considerations**

The consideration of a NESCO would start with an assessment of the interest of existing nonprofit or cooperative entities that have the technical and financial expertise and management capacity to operate the NESCO as a program or a subsidiary. Potential sponsors could include rural electric cooperatives, other energy cooperatives, state renewable energy funds, energy efficiency utilities, biomass or forestry organizations, or community development financial institutions.

If one or more potential sponsors can be identified and enough facilities indicate a preference for this approach, potential funders could be contacted to gauge their interest in supporting a NESCO. If there is sufficient interest among funders, a business plan and grant proposals should be prepared.

### CREATIVE FINANCING FOR WOOD HEATING SYSTEMS (CONT’D)

#### FIGURE 6:
Estimated NESCO Operating Costs

<table>
<thead>
<tr>
<th>PERSONNEL</th>
<th>ANNUAL</th>
<th>FTE</th>
<th>COST W/BENEFITS</th>
</tr>
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<tr>
<td>Technical Person</td>
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<td>Management</td>
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<td>Admin Support</td>
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<td>Benefits</td>
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<td><strong>Subtotal</strong></td>
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</table>

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<tr>
<th>OPERATING EXPENSES</th>
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<th>ANNUAL</th>
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<td>Supplies</td>
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<td>Miscellaneous</td>
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<td><strong>Subtotal</strong></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$136,950</strong></td>
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VII. RELATED WORK

The North Country Forest Energy Project comprises a broad set of actions and initiatives further enhanced by the Northern Forest Biomass Energy Initiative (see below) and a number of other initiatives that also focus on the North Country of New Hampshire and surrounding states. Funding from the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation to BERC provides a unification of purpose that advances the same agenda of community economic development through wood energy across these initiatives, with the ultimate benefits flowing to Coos County and the rest of the region.

NORTHERN FOREST BIOMASS ENERGY INITIATIVE (NFBEI)

The NFBEI was convened by BERC and the Northern Forest Center in January of 2006. The conveners were also joined by the Carsey Institute of the University of New Hampshire.

The overall purposes of the initiative are to:
- Explore the potential for woody biomass from the Northern Forest to provide an increased source of renewable, sustainable energy for the region
- Determine what needs to happen for that potential to be realized

The NFBEI has held several steering committee meetings and one working session conference, with the development of an NFBEI Action Plan as an outcome of this intensive work with stakeholders. Currently, the convening organizations have sought and received endorsements for the action plan, and presented the endorsed action plan to the four state governors and Congressional delegations to petition support for implementing its recommendations. Many of the initiatives of the North Country Forest Energy Project were designed to apply the policy recommendations made in the NFBEI Action Plan to Coos County.

US FOREST SERVICE “JUMP START” GRANT

The North Country RC&D submitted a successful proposal to the US Forest Service “Jump Start” solicitation for a set of activities called, “Increasing Community-Scale Biomass Heating in New Hampshire.” Under this grant, the North Country RC&D and its partners have developed public education materials, conducted tours of wood energy systems for potential users and other stakeholders, and carried out preliminary 50 percent cost-shared feasibility studies for wood energy at Plymouth State University (PSU), a state Division of Forest and Lands warehouse facility, and three schools or similar public buildings.

BERC has been influential in providing the conceptual basis on which the RC&D project is based, and worked closely with the PSU Center for Rural Partnerships in formulating its biomass feasibility study scope. Feasibility studies were awarded on a competitive basis and were completed in September of 2008. BERC conducted two of the feasibility studies and reviewed the other studies, all of which can be found on the North Country RC&D website.

BERC was an integral part of the advisory group in developing informational materials to be distributed to schools and municipal officials about the potential benefits of converting existing oil- and gas-fueled heating systems to woody biomass. The group decided to use a slogan “Money does not grow on trees!” NH DOE is also considering printing additional copies of these outreach materials.

Three workshops were conducted for schools and municipal buildings in the last week of March 2008, with a morning informational panel and afternoon field trips. A variety of geographic locations and technologies were represented in the site visits.
The communities of the North Country are literally at the end of the pipeline for fossil fuels and currently dependant on fuel oil and propane for economic survival. When non-renewable fossil fuel prices rise sharply, and as competition for available oil resources sharpens, these communities will be among the hardest hit.

During the summer of 2008, oil prices were seen to rise to unprecedented levels. Although they have since dropped, this situation demonstrated the instability of the oil market and the dangers of depending on an imported fuel source with volatile pricing. Developing the use of biomass heating for schools, community buildings, hospitals, and downtown areas will provide benefits to consumers, tax payers, and the local economy, and help protect forestry jobs and infrastructure at risk since the closing of the area’s paper mills over the last decades.

The benefits of biomass, however, have not yet been realized by many municipal decision makers. Even with low-cost feasibility studies available through the USFS Jump Start Program and no-cost feasibility studies available through this project, many officials and decision makers declined participating in a study for their facilities. BERC sees a clear need for greater information and public education activities to promote the benefits of biomass heating in Coos County communities.

BERC also seeks to promote the development of a pilot project in the area. A pilot project demonstrates the efficiency and ease of modern wood-burning technology and the economic benefits to the facility and the local economy. BERC hopes to help move forward the nearby Grafton County complex project as well as continuing to help decision makers who have participated in the feasibility studies mentioned here. As pilot projects in the area are completed, BERC plans to organize information and education materials and events in Coos County to help publicize these projects and their benefits.

Support for the North Country Forest Energy Project by the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation has allowed BERC to:

- Strengthen the community heating program in New Hampshire
- Identify and prioritize ideal sites for wood energy projects
- Investigate creative ways to finance them

The North Country Forest Energy Project has brought focus and expertise to an area that has been gaining national momentum: increased economic and energy security for rural communities through the use of local, low-grade wood resources for energy supply. BERC has established key partnership with program and project stakeholders in Coos County as well as the State of New Hampshire.

The project has already provided the impetus for a significant body of related work initiated by BERC and its partners to advance the concept of community-scale wood energy and implement wood energy projects in Coos County and the rest of the North Country. During the first two years of the project, BERC developed the New Hampshire Community-Scale Biomass Heating Program concept with state agencies and other partners, convening regularly to ascertain means of securing program support and develop education and outreach materials.

All of this significant work would not have been possible without the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation funding for BERC and its North Country Forest Energy Project, and BERC is extremely appreciative of this support.