Local Wood Energy:

Biomass in Community Energy Projects for Energy Security, Forest Sustainability, Climate Mitigation, and Local Economic Development

Presentation to:

Clean Energy States Alliance

December 17, 2010

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Biomass Energy Resource Center
US Energy Consumption –

Approximately one third of US energy consumption is Thermal

Source: Energy Information Association, 2006
Local Energy –
A relationship between communities and their forests
Forest Resources in the US

Data Sources
- Forests: Univ. of Maryland, MODIS Vegetation Continuous Fields
- Public ownership: Univ. of California Santa Barbara, Managed Area Database
- States: ESRI Data and Maps

USDA Forest Service
Forest Inventory and Analysis
National Woodland Owner Survey
Biomass Applications
Biomass for Heat: A Cost-Effective Fuel

Heating Fuel Costs
(per MMBtu after Combustion)

- Natural Gas: $14.96
- Oil: $24.35
- Propane: $13.99
- Woodchips: $7.22
- Wood Pellets: $20.15
- Corn: $13.39

Heating with biomass is less expensive than heating with fossil fuels.

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Cost-Effectiveness – Some Additional Perspective

<table>
<thead>
<tr>
<th>Price of Woodchips</th>
<th>Equivalent Price of Heating Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>$30/GT</td>
<td>$0.51/gallon</td>
</tr>
<tr>
<td>$40/GT</td>
<td>$0.68/gallon</td>
</tr>
<tr>
<td>$50/GT</td>
<td>$0.86/gallon</td>
</tr>
<tr>
<td>$60/GT</td>
<td>$1.03/gallon</td>
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<td>$70/GT</td>
<td>$1.19/gallon</td>
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<td>$80/GT</td>
<td>$1.37/gallon</td>
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<td>$90/GT</td>
<td>$1.53/gallon</td>
</tr>
<tr>
<td>$100/GT</td>
<td>$1.70/gallon</td>
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Critical Issues for the Development of Biomass Energy

• Wood Supply
• Sustainable Harvesting
• Scale & Efficiency
• Harvesting Capacity
• Investment & Financing
• Emissions
• Climate Change
Wood Supply
Support biomass energy applications that are consistent with a reliable and sustainable wood supply

Ecological sustainability
Economic flexibility and resilience
Dynamic and ongoing assessment

- **Actions:**
  - States: Wood Fuel Supply Studies
  - National level: Emerging policy conversations about thermal energy

- **Opportunities:**
  - Consider tools and techniques to support sustainable harvesting levels
  - Need for regional consistency
  - Federal lands
Best-in-Class Community-Scale Biomass Systems Case Study Series

Wood Supply
Biomass energy applications must be consistent with a reliable and sustainable wood supply

Forestland Area and Ownership Data
Forest Inventory and Composition Data
Forest Growth and Mortality Data
Current Forest Harvesting Data

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Vermont Counties (Green Tons NALG Wood)</th>
<th>Total 24 County Area (Green Tons NALG Wood)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative</td>
<td>387,491</td>
<td>1,137,267</td>
</tr>
<tr>
<td>Moderate</td>
<td>1,466,982</td>
<td>3,423,082</td>
</tr>
<tr>
<td>Aggressive</td>
<td>2,342,053</td>
<td>5,343,465</td>
</tr>
</tbody>
</table>

Scenarios:
- Vermont Counties: Green Tons NALG Wood
- Total 24 County Area: Green Tons NALG Wood

Forest Inventory and Composition Data
Forest Growth and Mortality Data
Current Forest Harvesting Data

**Scenario Vermont Counties**

- **Conservative**: 387,491 (Green Tons NALG Wood)
- **Moderate**: 1,466,982 (Green Tons NALG Wood)
- **Aggressive**: 2,342,053 (Green Tons NALG Wood)
Physical Limitations and Ecologically Inappropriate Areas

GIS Analysis Filtering for:
- Deer Yards
- Excessive Slopes
- Wilderness Areas
- Wetlands
- Stream Buffers
- High Elevations
- Etc.
Sustainable Harvesting:
Ensure removals are consistent with long-term forest health and productivity through an integrated approach

- Biomass Harvesting Standards
- Wood Fuel procurement Guidelines
- Integrated forest management – issues not unique to biomass

**Actions:**
- Assessment of Biomass Harvesting Guidelines (state BMP’s)
- Forest Guild/BERC process to develop biomass harvesting guidelines for northeastern forests
- Forest Guild national biomass harvesting case studies report

**Opportunities:**
- Recommend tools and options to ensure sustainability including harvesting guidelines, procurement standards, integration of supply and harvesting
- State Procurement for existing and developing systems
Scale & Efficiency:

If used efficiently, woody biomass could replace significant portions of the nation’s petroleum use with a local renewable fuel source.

- Used for heat or heat-led CHP, woody biomass is approximately 75% efficient
- Used for generating electricity alone, woody biomass is 20-25% efficient
- Used for making ethanol, woody biomass is 40-50% efficient

• Actions:
  - National thermal energy policy

• Opportunities:
  • District Energy Projects
  - Fuels for Schools
  - Public buildings/campuses/institutions
About how much wood might the potential Uses consume?

**Industrial Uses:**
- Bio-oil: 50,000-100,000 tons/plant?
- Cellulosic ethanol (at scale): 300,000-1,500,000 tons/plant
- Power plants: 200,000-600,000 tons/ plant

**Community Uses:**
- One school: 200-1,000 tons
- 30 Schools: 15,000 tons
- All schools in Maine: 250,000 tons
- Middlebury College: 30,000 tons
- VT State office complex: 5,000 tons
- Crotched Mountain Rehab Ctr. (NH Hospital): 3,000 tons
- Public housing (50 units): 450 tons

All in green tons
Conversion Efficiency
Wood Residues to Energy and Bio-fuels

Technology Pathway Efficiencies

- Gross Thermal Efficiency (%)
- Net Product Efficiency (%)
- Net Electrical Efficiency (%)
The transition to modern wood heating: Efficiency increase from 50% to >90%
Harvesting Capacity:

Challenge:
- aging workforce
- access to capital
- shifting scale of operations

Opportunity & Action:
- shifting economy
- expansion of wood energy markets
- market development for wood products vs. lower harvesting costs
- new financing options (loans, incentives) for harvesting equipment
- new revolving loan fund, financing options
- BCAP??
Emissions Control Equipment

Recommendations
While vastly more efficient than a typical wood stove, biomass boilers do have higher particulate matter emissions than oil or natural gas.

• Electrostatic Precipitator
  - Most efficient in collecting large particles,
  most expensive, not always readily available

• Cyclone
  - Efficient in collecting large particles

• Baghouse
  - Can have particulate control efficiencies of 99%

• Properly Sited Stack
  - Height dependent upon local air standards and proximity to nearby buildings
Particulate Matter from Various Wood Combustion Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Lbs/million Btu Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older Residential Stove</td>
<td></td>
</tr>
<tr>
<td>EPA Certified Stove</td>
<td></td>
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<tr>
<td>Pellet Stove</td>
<td></td>
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<tr>
<td>Industrial Wood Boilers</td>
<td></td>
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<tr>
<td>School-sized Boilers</td>
<td></td>
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<tr>
<td>McNeil Generating Plant</td>
<td></td>
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</tbody>
</table>

1. Data from [reference 1]
2. Data from [reference 2]
3. Data from [reference 3]
4. Data from [reference 4]
5. Data from [reference 5]
6. Data from [reference 6]
Emissions:
Minimize emissions and meet or surpass stringent public health and air quality standards

- Efficient combustion technologies
- Best air pollution control strategies
- Best management practices

Action:
- New EPA Area Source Rule for Wood Boilers – April ’10 proposed – now minimum 5/11 – request for 5/2012!
- Tailoring Rule
- ESP Application – National Life Bldg., Mont. VT

Opportunity:
- Vermont leadership based on long track record of school wood energy
- Development of clean, efficient district energy systems in towns and cities
Climate Change:
Used efficiently and from sustainably managed forests, woody biomass has the potential to displace fossil fuels and reduce atmospheric CO2 emissions.

- Forest types
- Harvesting regimes
- Fuel type
- Fuel transport
- Efficiency of Appl.

Action:
- BERC/RSG study to document carbon impacts of community scaled wood energy in northeastern forests
- MA DOER study
- NE Forest Carbon Assessments

Opportunities:
- Invest funds in efficient biomass energy technologies
- Develop national carbon policy that links biomass energy to carbon sequestration role of forests
- Use state, regional or national carbon registries to measure, aggregate and verify carbon offsets
National Energy Policy

Develop an “outcome-based” energy policy based on achieving efficiency, sustainability, renewability and security
  - Rather than a “sector-based” approach boosting one technology over another

Existing public policy is creating market distortions that are undermining these policy objectives
  - Must look at all energy sectors
  - Must look beyond short-term pricing
  - Need to develop a new paradigm – not just new fuels
$29 Billion on Renewable Energy Subsidies
$72 Billion on Fossil Fuel Subsidies
(2002-2008)

Transportation fuels: $16 billion – through the Volumetric Ethanol Excise Tax Credit Program (VEETC) ($11 billion) and the corn-based ethanol grant program ($5 billion).

Renewable electricity generation: $6 billion – through the Production Tax Credit ($5 billion), the Investment Tax Credit ($250 million), the Modified Accelerated Cost Recovery System ($200 million), and the Clean Renewable Energy Bond program ($85 million).

Thermal energy: $0 – no significant subsidies.

Environmental Law Institute, 2009
Public Policy to Support Efficient, Sustainable Biomass Energy

National Thermal Energy Policy

• All Fuels/All Sector Renewable Energy Standard with efficiency threshold
• Carbon policy that supports the most efficient uses of biomass and links to carbon sequestration role of biomass
• Federal incentives, grants and loans
• Inclusive definition of Biomass
• Sustainability requirements

Additional critical issues at the state and/or national levels:

• Sustainable Woody Biomass Supply
• Sustainable Forest Management and Use
• Air Emission Standards and Regulations
Public Policy to Support Efficient, Sustainable Biomass Energy

Comprehensive National Energy Policy (Electric, Transportation and Thermal)
- All Fuels/All Sector Renewable Energy Standard with efficiency threshold
- Carbon policy that supports the most efficient uses of biomass and links to carbon sequestration role of biomass
- Federal incentives, grants and loans
- Inclusive definition of Biomass
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Additional critical issues at the state and/or national levels:
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Current Biomass Energy Public Policy Initiatives

**National Programs**
Community Wood Energy Program
Energy Independence and Security Act of 2007 - Sec 399a
Biomass Crop Assistance Program
DOE & USDA grant programs

**State Programs**
Primary focus on electric generation: RPS, REC’s
Transportation: CA, MN, OR, PA, WA, WI
Thermal: AZ, CT, MS, OR, PA, VT, WA, WI)
Proposed Biomass Energy Policy

**BCAP Review:** Final rule issued. Funding?

**EPA Emission Standards for Biomass Boilers:** Proposed rule now delayed

**Homestar:** Rebates for energy efficiency products including wood/pellet stoves & boilers

**PACE:** Financing through municipal tax payments. In trouble or getting resolved?

**Climate Energy Bill:** Electric Power focus; Carbon Accounting, Biomass Definition

**EPA Tailoring Rule:** EPA proposal to include CO2 emissions from biomass boilers under Clean Air Act

**District Energy Financing**
- S.1621 Thermal Energy Efficiency Act
- Energy & Water Development Appropriations Act ($15m for district energy feasibility studies)
Proposed Biomass Energy Policy

**Residential Tax Credits**
- HR 2080, American Renewable Biomass Heating Act
- S.1643 Cleaner, Secure, Affordable Thermal Energy Act

**Commercial/Industrial Tax Credits**
- S. 3188, American Renewable Biomass Heating Act

**Production Tax Credits**
- S.1094 Renewable Energy Production Act
- HR.5805 Thermal Renewable Energy and Efficiency Act (Thermal PTC, bonding, DOE Grants)

**Renewable Energy Credits**
- S.1462 American Clean Energy Leadership Act (telescoping REC’s for efficiency) (Shaheen)

**District Energy Financing**
- S.1621 Thermal Energy Efficiency Act
- Energy & Water Development Appropriations Act ($15m for district energy feasibility studies)
Applications
The Vermont Experience

- 2 power plants
- 41 Public Schools
- 1 Hospital
- 5 State Office Complexes
- 3 Housing Complexes
- 3 College Campuses
- Dozens of businesses
School Case Study

Barre Town Elementary School  
Barre, Vermont

Size  - 160,000 sq. ft. / 1000 students  
Heating System  - Wood chips, converted from electric heat  
Fuel Use  - 650 tons/year  
Annual Heating Cost  - $19,000  
Annual Savings – $100,000 per year (1997)
Woodchip-fired District Energy

Middlebury College, Vermont
District Heating - Campus

- District heating & cooling system

- Cutting fuel oil usage in half or 40% reduction (12,500 tons/yr CO2) greenhouse gas emissions

- Local fuel/local economy – 75 mile radius and Willow plantation, 20,000 – 21,000 tons chips/year

- At 2008 fuel prices, $2 million annual cost savings

- CHP – 2-2.5 million kilowatt hours electricity (1/5 campus electricity needs)

- Student learning opportunity

**Middlebury College, Middlebury, Vermont**
South Tyrol (1994)
Best-in-Class
Community-Scale
Biomass Systems
Case Study Series
South Tyrol (2009)

- 55 District heating plants
- = 50% of the whole region
- 230 MW thermal power
- 440 Mio. kWh production
- > 40 Mio. litres of oil replaced
- = 119,000 tons CO₂
- 220,000 ton/yr biomass

Quelle: Südtiroler Biomasseverband
South Tyrol, Italy
Price comparison

<table>
<thead>
<tr>
<th>Year</th>
<th>Heating Oil</th>
<th>District Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>2007</td>
<td>160</td>
<td>10</td>
</tr>
</tbody>
</table>

Bar graph comparing Heating Oil and District Heating prices in South Tyrol, Italy from 1995 to 2007.
Other Community Benefits

An Austrian study shows another benefit

Energy costs circulate within the community – don’t leave it.

Ol-Heizung = Oil Heating

Holz-Heizung – Wood Heating

The Tyrol Region also benefits from money staying local.

With biomass district energy, currency stays in the community and in the region. Most oil heating funds went “Ausland” or “away.”
Other Community Benefits

...and...Jobs stay in the community – don’t leave it.

Arbeit = Work

Only 9 jobs were created from use of oil & natural gas heating.

135 jobs were created from biomass district heating
Vision and Principles for Community Scaled Biomass Energy

**Sustainable Forestry** – to keep the forest healthy and ensure overall ecological integrity and function

**Maximized Efficiency** – to ensure the energy value of biomass is utilized as fully and cleanly as possible

**Local Energy** – to use local wood resources for community and regional needs and keep investment and returns local

**Energy Security** – to provide communities with a stable, affordable clean, and locally produced source of energy

**Climate Change Mitigation** – to reduce net carbon emissions and increase carbon sequestration through sustainable biomass energy
Thank You!

Contact Information

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