WOOD BIOMASS RESOURCES IN MICHIGAN

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Forest Mineral and Fire Management
May 22, 2008

Department of Natural Resources
Forest Resource Management

• Gather, Analyze & Disseminate Relevant Information
• Make the tie to Sustainable Management & Community Economic Growth
• Management Responsibilities for 3.9 Million Acres of State Forest Lands
Partners in Promoting Wood Biomass Energy in Michigan

- Michigan State University
- USDA Forest Service
- Michigan Technological University
- Michigan Biomass Energy Program
- SE Michigan RC&D Council
- UP RC&D Council
- Industry and Other Interested Parties

Biomass Energy from Wood

- Renewable
- Local
- Reliable
- Sustainable
- Affordable
- Low carbon emission
- Minimal ash
- Very low metals and sulfur

- Good option for schools, hospitals, and other institutions facing high energy costs
- Can be used through new construction or boiler retrofit
Compared to other bioenergy feedstocks, forestry sources have best outlook for feasibility and environmental sustainability.

- Corn = extensive cultivation, fertilization, and pest control
- Forests = extensive availability, largely unutilized, lower-impact harvesting

From – Biomass, Biofuels and Bioenergy: Feedstock Opportunities in MI
Robert E. Froese, Ph.D.; February 2007

Presentation Overview

- What is Woody Biomass
- Sources & Availability of Woody Biomass
- Current Uses & Markets for Woody Biomass
- Other Issues Related to Woody Biomass
- The Future
What is Woody Biomass

• Biomass is simply any organic material – living or dead

• Woody biomass includes entire living & dead trees, brush, stems, logs & residue material generated throughout various forest product processing

Woody Biomass Sources

– Tops, limbs, & brush after timber harvests
– Small diameter & noncommercial timber
– Wood manufacturing residues
– Urban wood (including tree removals and clean sources of industrial wood residues and construction debris)
Factors Affecting Woody Biomass Availability

- Landowner Values (over half is private)
- Price
- Sustainability Requirements
- Competing Uses
- Changing Markets

Best Sources for Institutions?

- It all depends on where you are –
  - Urban area? Look for urban sources – city tree removals, pallet recycling operations, clean crates and dunnage
  - Rural area? Look to local forestland owners, forest products companies
- Always keep fuel quality and dimensions in mind when securing wood sources (chip vs. ground, etc.)
## Potential Production of Various Biofeedstocks in Michigan

<table>
<thead>
<tr>
<th>Source</th>
<th>Land Area (million acres)</th>
<th>Annual Yield (in millions of dry tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody energy crops on idle land</td>
<td>3.2</td>
<td>7.2</td>
</tr>
<tr>
<td>Woody energy from excess forest growth</td>
<td>19.3</td>
<td>6.5</td>
</tr>
<tr>
<td>Wood biomass from urban trees (annual yield based on 1.5% mortality rate for standing trees)</td>
<td>2.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Mill Residues</td>
<td>--</td>
<td>1.4</td>
</tr>
<tr>
<td>Logging Residues</td>
<td>--</td>
<td>1.3</td>
</tr>
<tr>
<td>Switchgrass from CRP lands</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Crop residues</td>
<td>8.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Manure, Landfill, &amp; Other</td>
<td>Less than 0.6</td>
<td></td>
</tr>
</tbody>
</table>

*Sources: USDA Forest Service – Forest Inventory and Analysis for Michigan; USDA Agriculture Statistics Service; Michigan State University; National Renewable Energy Laboratory (compiled by Ray Miller, MSU)*

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**Table 3—Annual Biomass Quantities in Michigan (est. dry tons), by Type and Delivered Price**

<table>
<thead>
<tr>
<th>Biomass Type</th>
<th>&lt; $20/dry ton</th>
<th>&lt; $30/dry ton</th>
<th>&lt; $40/dry ton</th>
<th>&lt; $50/dry ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Wood Residue</td>
<td>495,734</td>
<td>825,224</td>
<td>825,224</td>
<td>825,224</td>
</tr>
<tr>
<td>Mill Residues</td>
<td>10,000</td>
<td>332,000</td>
<td>1,248,000 (est)</td>
<td>1,564,000</td>
</tr>
<tr>
<td>Forest Residue</td>
<td>0</td>
<td>710,000</td>
<td>1,034,000</td>
<td>1,327,900</td>
</tr>
<tr>
<td>Energy Crocs</td>
<td>0</td>
<td>0</td>
<td>1,154,229</td>
<td>4,179,308</td>
</tr>
<tr>
<td>Ag Residues</td>
<td>0</td>
<td>0</td>
<td>680,763</td>
<td>4,265,671</td>
</tr>
</tbody>
</table>

Forecast Bioenergy Feedstock Supply in Michigan in dry tons per year.

<table>
<thead>
<tr>
<th>Biomass Feedstock</th>
<th>Potential Supply</th>
<th>Currently Available and Unutilized</th>
<th>Available at $25/ton Farmgate Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawmill and pulp mill residues</td>
<td>1,764,796</td>
<td>Negl.</td>
<td>405,903</td>
</tr>
<tr>
<td>Logging residues</td>
<td>869,468</td>
<td>869,468</td>
<td>113,031</td>
</tr>
<tr>
<td>Thinning residues</td>
<td>1,875,978</td>
<td>1,875,978</td>
<td>243,877</td>
</tr>
<tr>
<td>Forestry Total</td>
<td>4,510,243</td>
<td>2,745,447</td>
<td>762,811</td>
</tr>
<tr>
<td>Urban Wood Waste</td>
<td>1,311,382</td>
<td>1,311,382</td>
<td>314,732</td>
</tr>
<tr>
<td>Dedicated Energy Crops</td>
<td>4,418,226</td>
<td>Negl.</td>
<td>44,182</td>
</tr>
<tr>
<td>Grand Total</td>
<td>10,239,851</td>
<td>4,056,829</td>
<td>1,121,725</td>
</tr>
</tbody>
</table>

Sources: USDA, DOE, Walsh (2006) and Michigan Technological University.
Woody Biomass Sources

• Tree removals & trimmings (logs, limbs, stumps)
• Manufacturing byproducts (edgings, cutoffs, chips, shavings)
• Discarded packaging (pallets, skids, crates, dunnage)
• Construction/demolition
• Railroad ties
• Telephone poles

Urban Wood Residue Sources
Traditionally, communities pay large amounts for BOTH heating fuel and disposal of removed trees.

For example:
City X pays –
$25,000/yr to heat city hall
AND
$25,000/yr for wood disposal

What happens to these figures if they get a wood boiler?

MI Urban Wood Estimates
2007 SEMIRCD Study – Sherrill & MacFarlane
• Studied green & brown urban wood residues
• 4.4 million cubic yards of wood residues were discarded as waste in 2005 (over half of all wood generated in area)

1994 Public Policy Associates study –
Urban Wood Waste in Michigan Supply & Policy Issues
• 659,328 tons, 45% utilized
• 8,848,527 MBtus

1999 Oak Ridge National Laboratory study –
Biomass Feedstock Availability in the U.S.
• Estimated 826,224, dry tons/yr
• Delivered price of <$30/dry ton
# Urban Wood Residue Generation in 13 Counties of SE Michigan for 2005

<table>
<thead>
<tr>
<th>Residue</th>
<th>Total Amount Generated (cubic yards)</th>
<th>Percent Used</th>
<th>Total Amount Used (cubic yards)</th>
<th>Percent Discarded</th>
<th>Total Amount Discarded (cubic yards)</th>
<th>Of Total Amount Discarded, Amount Sent to Landfills (cubic yards)</th>
<th>Percent of Total Discarded Residue Sent to Landfills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallets, Skids, Shipping Crates</td>
<td>503,000</td>
<td>84%</td>
<td>424,000</td>
<td>14%</td>
<td>81,000</td>
<td>15,000</td>
<td>19%</td>
</tr>
<tr>
<td>Edgings and Cut-offs</td>
<td>2,046,000</td>
<td>40%</td>
<td>1,038,000</td>
<td>60%</td>
<td>1,188,000</td>
<td>675,000</td>
<td>43%</td>
</tr>
<tr>
<td>Chips, Shavings, Sandblasting</td>
<td>480,000</td>
<td>48%</td>
<td>210,000</td>
<td>52%</td>
<td>250,000</td>
<td>108,000</td>
<td>43%</td>
</tr>
<tr>
<td>Construction Debris</td>
<td>3,828,000</td>
<td>37%</td>
<td>1,416,000</td>
<td>63%</td>
<td>2,412,000</td>
<td>1,302,000</td>
<td>54%</td>
</tr>
<tr>
<td>Tree Trunks, Limbs, Stumps</td>
<td>84,000</td>
<td>53%</td>
<td>45,000</td>
<td>43%</td>
<td>39,000</td>
<td>5,000</td>
<td>13%</td>
</tr>
<tr>
<td>Totals</td>
<td>7,543,000</td>
<td>42%</td>
<td>3,173,000</td>
<td>58%</td>
<td>4,370,000</td>
<td>2,105,000</td>
<td>48%</td>
</tr>
</tbody>
</table>

**Measures of Wood Resources in Lower Michigan: Wood Residues and the Saw Timber Content of Urban Forests (Sherrill & MacFarlane, 2007)**

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# Woody Biomass Sources

- Forest Slash & Thinnings
Woody Biomass Sources

Small-diameter Timber

From – Biomass, Biofuels and Bioenergy: Feedstock Opportunities in MI
Robert E. Froese, Ph.D.; February 2007
Woody Biomass Resource
Current Uses & Markets

Trends

• Housing decline and new OSB capacity have weakened structural panel markets
• Rising imports of furniture from Asia undermine markets for hardwood lumber and non-structural panels
• Weaker pulp and paper demand
• North American pulp and paper producers facing pressure from international competition and trade

Source: RISI 2007
Due to Changes in Industry, More Wood is Now Available

<table>
<thead>
<tr>
<th>Michigan Primary Mill Closures from 2003 to Present:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mills</td>
</tr>
<tr>
<td>Pulpmills</td>
</tr>
<tr>
<td>Menasha Corporation</td>
</tr>
<tr>
<td>Sappi Fine Paper</td>
</tr>
<tr>
<td>Particle Board Mills</td>
</tr>
<tr>
<td>GFP Strandwood Molding Corp.</td>
</tr>
<tr>
<td>Georgia-Pacific Corp.</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Wood Energy Facilities in Michigan

Table 1—Facilities Producing Wood Energy in Michigan
Source: MDEE, online at http://www.mdeenergy.org/

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity (kW/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michigan Total</td>
<td>305,172</td>
</tr>
<tr>
<td>Utility (non-utility)</td>
<td>173,153</td>
</tr>
<tr>
<td>Upper Peninsula</td>
<td>150,000</td>
</tr>
<tr>
<td>Lower Peninsula</td>
<td>46,278</td>
</tr>
</tbody>
</table>
Competing Markets

- Mulch & hydromulch
- Pulp & paper
- Wood composites
- Landfill cover
- Bulking agents
- Soil amendments
- Animal bedding
- Biofilter media
- Refurbished pallets
- Solid wood milled products

Other Issues

- Location – distinguishing residues from waste
- Landfills and tipping fees
- Transportation
- Harvesting
- Collection
- Processing – drying, chip size requirements
The Future

Emerging Michigan Markets

- Fuel pellets
- Liquid fuels
- Biorefineries

Other Resources
Clean Energy from Wood Residues in Michigan

Michigan Biomass Energy Program
Dawne Sipples, Coordinator
Discussion Paper
June 2006

www.michiganwoodenergy.org

Is wood fuel right for your boiler?
- Calculate Costs
- Learn More

WOOD
The local, clean, renewable, affordable, sustainable fuel choice.

- Learn about wood energy options in Michigan
- See report of 2000 potential sites for wood boiler projects
- Use calculator to estimate savings at your site
Michigan’s Opportunities

- Existing forest businesses and infrastructure
- Productive forest
- High quality hardwoods
- Higher Gross Vehicle Weights
- Ingenuity
- Bioeconomy (liquid fuel, heat and electricity)

Bioeconomy Challenges

- Developing manufacturing technology for liquid fuel production
- Redesign harvest and transportation technologies
- Understand feedstock inventory & availability to support investor decisions
Acknowledgements

Additional technical support is provided by

Through funding from

Thank you

Great Lakes, Great Times, Great Outdoors

www.michigan.gov