Kickapoo Valley Solid Biofuel & Wood Product Feasibility Study

Initial Findings & Public Input Meeting

July 16th, 2:00pm – 4:00pm
Kickapoo Valley Reserve
S3361 State Highway 131
La Farge, Wisconsin

Presentation by:
Andrew Dane, Community Development & Sustainability Specialist, Short Elliott Hendrickson Inc (SEH)
Don Peterson, President, Renewable Resource Solutions LLC (RRS)
Kickapoo Valley Solid Biofuel & Wood Product Feasibility Study

Vision: Create a More Resilient Economy

- Chips
- Roundwood
- Dry Residues
- Green Residues

- Create Quality Jobs
- Improve Energy Security
- Increase Income Levels
- Resource Protection

- Pallet Plant
- Pellet Plant/Bioresinry

- Residential Pellets
  - Industrial Pellets
  - Value Added Products
  - Advanced Bio-Products

- Thermowood
- Nanotechnology/Liquid Biofuels

- BBQ Pellets
- Animal Bedding & Litter
- Wood Flour

- Community Center
- District Heating/CHP
- School
- Food Processing
- Hospital/Clinic
- Poultry
Study Design

• Chapter 1 – Issues and Opportunities
• Chapter 2 – Resource Analysis, Supply Chain Evaluation, and Stumpage Estimates
• Chapter 3 – Pellet & Wood Chip Technology Overview
• Chapter 4 – Regional Household & Institutional Survey
• Chapter 5 – Opportunities for Small Scale District Heating
• Chapter 6 – Wood Pellet Plant Feasibility Study
• Chapter 7 – New Business Opportunities
• Chapter 8 – Recommendations
4a. Sustainable Forest Harvest Thresholds

- Forest Inventory Analysis Data
  - Starting Point
- Private Forest Ownership Data
  - MFL
  - County Cutting Notices
  - Mill data

Need to blend the two to get an accurate assessment of availability of resources.
4b. Market Stumpage Rates

• Available from the DNR and private publications

• Most current information will be used when final report is printed
4b. Projections for Low Value Products

- Pulpwood
- Wood Fuel
- Mulch
- Animal Bedding
- Other
4c. Sustainable Forest Harvest at Reasonable Rates of Return – Pricing Thresholds

• Ratchet effect on stumpage:
  – Price goes up but does not come down as fast

• As price goes up timber availability increases. When landowners feel the market is strong and they are getting a good price, more is sold.

• Perception of need is important, if local papers have articles on mills needing wood and paying higher than average prices, people will think more of selling timber.

• Tightrope for mills, they have to be careful not to pay too much so they stay profitable

• Since this is so hard to document, it stands to reason this may be perceptually driven.
4d. Pellet Market Trends

Regionally – Natural Gas and Quality Driven

Nationally – Natural Gas, Quality, and Convenience Driven

Internationally – Policy Driven
### 4d. Regional Pellet Market Trends

<table>
<thead>
<tr>
<th>Company</th>
<th>City</th>
<th>State</th>
<th>Feedstock</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Wood Fibers</td>
<td>Schofield</td>
<td>WI</td>
<td>Hardwood and Softwood (Mill)</td>
<td>25,000 Tons</td>
</tr>
<tr>
<td>Dejno's Inc.</td>
<td>Kenosha</td>
<td>WI</td>
<td>Hardwood and Softwood (Mill)</td>
<td>40,000 Tons</td>
</tr>
<tr>
<td>Fiber Recovery Inc.</td>
<td>Ringle</td>
<td>WI</td>
<td>Hardwood (Mill)</td>
<td>13,000 Tons</td>
</tr>
<tr>
<td>Great Lakes Renewable Energy, Inc.</td>
<td>Hayward</td>
<td>WI</td>
<td>Hardwood and Softwood (Forest)</td>
<td>70,000 Tons</td>
</tr>
<tr>
<td>Green Friendly Pellets, LLC</td>
<td>New Richmond</td>
<td>WI</td>
<td>Hardwood</td>
<td>17,000 Tons</td>
</tr>
<tr>
<td>Greenwood Fuels</td>
<td>Green Bay</td>
<td>WI</td>
<td>Paper Waste</td>
<td>78,000 Tons</td>
</tr>
<tr>
<td>Indeck Energy</td>
<td>Ladysmith</td>
<td>WI</td>
<td>Hardwood (Mill and Forest)</td>
<td>90,000 Tons</td>
</tr>
<tr>
<td>Marth Peshtigo Pellet Company (Parent)</td>
<td>Peshtigo</td>
<td>WI</td>
<td>Hardwood (Mill and Forest)</td>
<td>64,000 Tons</td>
</tr>
<tr>
<td>Marth Wood Shavings Supply</td>
<td>Marathon</td>
<td>WI</td>
<td>Hardwood (Mill and Forest)</td>
<td>25,000 Tons</td>
</tr>
<tr>
<td>Pellet America Corp.</td>
<td>Appleton</td>
<td>WI</td>
<td>Paper Waste</td>
<td>50,000 Tons</td>
</tr>
</tbody>
</table>
4d. National Pellet Market Trends

- According to the *National Trade Association Hearth, Patio, and Barbeque*, annual sales of wood pellet stoves in the US have increased by nearly 300 percent in the past 10 years.

- Domestically, pellets compete best against fuel oil, propane, and electricity, with natural gas prices being very similar to pellet prices in the last year.
4d. International Pellet Market Trends

• Total shipments of wood pellets from the US and Canada to Europe has almost doubled in the past two years.

• Demand in European countries such as Sweden, the Netherlands, Belgium, Italy, Denmark, and the UK continues to outpace domestic production.

• Denham Capital has projected that by 2015, the worldwide pellet market potential is 142 million tons at a value of $2.8 billion.

• Projections for demand in the European Union (E.U.) range from 305 million tons to 500 million tons by 2020 (U.S. Endowment for Forestry, 2011).
4e. “New Technologies”

• What do we mean by “new” technologies?
  – Proven, cost effective technologies
    • Hot water boilers
    • Steam generating boilers
  – Suitable for this region
  – Capable of utilizing low grade wood or better yet by-products from local wood product industry
  – “New” in the sense they are not common to the area but have a proven track record using reliable, off the shelf technology
4e. “New Technologies”

• Previous Studies & Commentary
    • CHP not competitive where natural gas exists
    • Areas where biomass can compete include fuel switching from propane, fuel oil, or electric heating
    • Lack of large heat demand can be problematic when generating power
• 4e. Biomass Conversion Efficiencies
System provides heat for elementary and high schools, hospital, medical center and nursing home
4e. Case Study: Pinecrest Nursing Home

Provides Heating, Domestic Hot Water, and Cooling

Source: HTM 2013 PPT
4e. Case Study: Muscoda Protein Products and Meister Cheese

- Wood boiler installation project
  - 400 HP boiler
  - Project cost of $1,700,000
  - USDA funding of $430,000
  - Estimated annual savings of 600,000 therms of natural gas with a four year payback

- System provides process heat for cheese plant and whey drying facility
  - Pallet company ¼ mile down the road – environmental benefits using local waste vs. shipping to WI Rapids for paper production
  - Pallet trims used in AFS boiler which provides steam to cheese factory and whey drying facility (Meister Cheese)
4e. Case Study: Goeman’s Wood Products

- Wood boiler installation project
  - Grind scrap lumber into wood chips and burn them in a Hydronic hot water heating system used to heat entire 65,000 square foot facility and heating treat chamber
4e. Case Study: Wolf Ridge Environmental Learning Center

- Source: Peter Smerud
- Heating the Midwest 2013

100,000 sq ft of heated buildings
84,000 by wood
2-3’ of soil
4e. Case Study: Wolf Ridge Environmental Learning Center

WoodMaster BM 300 & 650
1.1 million btuh (300 KW)
2.2 million btuh (650 KW)
4e. Case Study: Wolf Ridge Environmental Learning Center

- **Computer controlled combustion**
  - Table:
    - **Status**: FIRE
    - **Water temp**: 160.0 °F, 160.2 °F
    - **Flue gas temp**: 250.1 °F
    - **Return temp**: 146.3 °F
    - **Negative pressure**: 20 Pa, 20 Pa
    - **O2-level**: 12.7 %, 13.2 %
    - **RPM**: 1500 rpm
    - **Load**: 23 %

- **175 tons/year, 1/4” & 3/8”**
  - Great Lakes Renewable Energy, Hayward, WI

- **Maintenance**:
  - 1x/week, 45 min
  - 1x/3 weeks, 2-3 hours
4e. Case Study: Memorial Medical Center, Ashland, WI

- Wood Fired Boiler installed in 1983
- Heating & Cooling
- 125 hp steam boiler = Approximately 4,000,000 btu maximum output
- 125 hp boiler = 200 tons of absorption cooling
- This takes care of about 1/3 of the buildings cooling load in the summer

  Source: By Joel Shilman
  Environmental Systems Coordinator
Wood chips from White River Hardwoods – Sanborn, WI

- Made from wood scrap from lumber business
- Current price $25/ton
- 75 ton/week
- ~ fuel cost $100,000/year
- Est. natural gas savings/year $200,000
4e. Summary of “new technologies”

- Wood chips for industrial, municipal, and commercial institutions
  - Heating and cooling
  - Domestic hot water
  - Process heat

- Pellets for residential & smaller institutions
  - Heating
  - Domestic hot water
4f. How to heat a house in the Kickapoo Valley

<table>
<thead>
<tr>
<th>County</th>
<th>Occupied Housing Units (1)</th>
<th>Bottled, Tank, or LP Gas</th>
<th>Fuel Oil, Kerosene, etc...</th>
<th>Electricity</th>
<th>Sub-Total</th>
<th>Utility Natural Gas</th>
<th>Wood</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crawford</td>
<td>6,812</td>
<td>19</td>
<td>5</td>
<td>11</td>
<td>35</td>
<td>47</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Monroe</td>
<td>17,376</td>
<td>23</td>
<td>5</td>
<td>13</td>
<td>41</td>
<td>45</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Vernon</td>
<td>11,616</td>
<td>28</td>
<td>8</td>
<td>11</td>
<td>48</td>
<td>32</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Richland</td>
<td>7,349</td>
<td>33</td>
<td>5</td>
<td>7</td>
<td>45</td>
<td>35</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>11</td>
<td>4</td>
<td>13</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) US Census 2010
# 4f. How to heat a house in the Kickapoo Valley

How to Heat a House (Popular Mechanics July 2011)

<table>
<thead>
<tr>
<th>Heat Type</th>
<th>Installed Cost</th>
<th>Efficiency</th>
<th>Fuel Unit</th>
<th>Fuel Cost (per unit)</th>
<th>Heat per Unit (BTU)</th>
<th>Fuel Cost (per MMBTU)</th>
<th>Annual Cost (Fuel/Maint.)</th>
<th>Svgs. Vs. Pellet Stove</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>3000-5500</td>
<td>80-98</td>
<td>Therm</td>
<td>1.05</td>
<td>100,000</td>
<td>13.52</td>
<td>1,352</td>
<td>-542</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>2300-3800</td>
<td>78-87</td>
<td>Gallon</td>
<td>2.65</td>
<td>138,900</td>
<td>26.46</td>
<td>2,646</td>
<td>752</td>
</tr>
<tr>
<td>Electric</td>
<td>5500-92-98</td>
<td></td>
<td>kWhr</td>
<td>0.111</td>
<td>3,412</td>
<td>33.21</td>
<td>3,321</td>
<td>1,427</td>
</tr>
<tr>
<td>Propane</td>
<td>2750-5650</td>
<td>78-98</td>
<td>Gallon</td>
<td>2.11</td>
<td>91,333</td>
<td>29.58</td>
<td>2,958</td>
<td>1,064</td>
</tr>
<tr>
<td>Wood Stove</td>
<td>3000-4200</td>
<td>78-98</td>
<td>Cord</td>
<td>200</td>
<td>22,000,000</td>
<td>12.99</td>
<td><strong>1,299</strong></td>
<td></td>
</tr>
<tr>
<td>Pellet Stove</td>
<td>3500-4000</td>
<td></td>
<td>70 Ton</td>
<td>250</td>
<td>16,500,000</td>
<td>18.94</td>
<td><strong>1,894</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13000-13000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry Heater</td>
<td>25000</td>
<td>78-85</td>
<td>Cord</td>
<td>200</td>
<td>22,000,000</td>
<td>11.36</td>
<td><strong>1,136</strong></td>
<td></td>
</tr>
</tbody>
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4f. How to heat a house in the Kickapoo Valley

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<tbody>
<tr>
<td>Crawford</td>
<td>6,812</td>
<td>1,294</td>
<td>341</td>
<td>749</td>
</tr>
<tr>
<td>Monroe</td>
<td>17,376</td>
<td>3,996</td>
<td>869</td>
<td>2,259</td>
</tr>
<tr>
<td>Vernon</td>
<td>11,616</td>
<td>3,252</td>
<td>929</td>
<td>1,278</td>
</tr>
<tr>
<td>Richland</td>
<td>7,349</td>
<td>2,425</td>
<td>367</td>
<td>514</td>
</tr>
<tr>
<td>4 County Region</td>
<td>43,153</td>
<td>10,968</td>
<td>2,506</td>
<td>4,800</td>
</tr>
</tbody>
</table>
### 4f. How to heat a house in the Kickapoo Valley

<table>
<thead>
<tr>
<th></th>
<th>10%</th>
<th>20%</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottled, Tank, or LP Gas</td>
<td>$1,167,039</td>
<td>6,581</td>
<td>$2,334,078</td>
</tr>
<tr>
<td>Fuel Oil, Kerosene, etc...</td>
<td>$188,461</td>
<td>1,504</td>
<td>$376,922</td>
</tr>
<tr>
<td>Electricity</td>
<td>$685,016</td>
<td>2,880</td>
<td>$1,370,031</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$2,040,515</strong></td>
<td><strong>10,965</strong></td>
<td><strong>$4,081,031</strong></td>
</tr>
</tbody>
</table>
4g. Pellet Plant Overview
4g. Manufacturing Process

- Manufacturing
- Raw Material
- Debarker
- Chipper
- Trammel Screen
- Initial Hammer Mill
- Tempering Tanks
- The Pellet Mill (Pelletizer)
- Cooling and Storage
- Bagging and Bulk
4g. Financial Information

- Projected Profits
- Feedstock Cost and Availability
- Pellet Revenue
- Cost of Project
4g. Operating Costs

- Raw Materials
- Direct Labor
- Feedstock Procurement Fees, Electricity, and Rentals
- Transportation Cost
- Supplies (consumable)
- Parts and Maintenance
- Equipment Replacement
- Insurance
4g. Additional Pellet Plant Information

- Feedstock Availability Constraints
- Raw Material Options
- PFI’s Fuel Grade Requirements for Residential and Commercial Wood Pellets
- LaFarge Resource Analysis Data
4h. “New” Forest Products from Kickapoo Valley

Kickapoo Valley Solid Biofuel & Wood Product Feasibility Study
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- Roundwood
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Pallet Plant

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- Increase Income Levels
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Pellet Plant/Biorefinery

- Residential Pellets
- Industrial Pellets
- Value Added Products
- Advanced Bio-Products
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4h. Ash

• Ash Lumber
  – Export Markets. Ash is strong domestically and the higher grades have an export potential.
  – This is primarily an opportunity for larger mills.

• Ash Biomass
  – Develop local users such as Gunderson Lutheran Hospital in Hillsboro
4h. Nanocellulose
4h. Nanocellulose

- FPL’s new Nanocellulose Pilot Plant
  - production facility for renewable, forest-based nanomaterials
  - $1.7 million pilot plant
  - First of its kind in the United States
  - Positions FPL as the country’s leading producer of forest-based nanomaterials
4h. Nanocellulose Continued

• FPL’s Nanocellulose Pilot Plant Will:
  – Bolster an emerging market for wood-derived renewable nanomaterials
  – Help to spur forest-based job growth
  – Contribute an estimated $600 billion to the American economy by 2020
4h. Nanocellulose - Commercialization

• The FPL’s facility will aid in the commercialization of nanocellulosic material by providing researchers and early adopters with working quantities of both cellulose nanocrystals and nanofibrils.
4h. Nanocellulose - Uses

- High strength at low weights (Nanocellulose-based materials can be stronger than Kevlar fiber.)
- Lightweight armor and ballistic glass
- Companies in the automotive, aerospace, electronics, consumer products, and medical device industries
4h. Thermo-Wood

Thermally-Modified Wood

- Not a substitute for CCA, ACQ, and related preservative-treated wood
- Chemical-free alternative to chemically-modified wood (mainly acetylated and furfurylated wood)
- Improved biological durability and dimensional stability
- Downgrade of some mechanical properties
- Does not impart insect resistance
TMT Production
Thermowood production update

RAW MATERIAL USED IN ThermoWood®-PRODUCTION

- 2003: 25,707 m³
- 2004: 34,958 m³
- 2005: 41,807 m³
- 2006: 63,919 m³
- 2007: 83,791 m³
- 2008: 84,273 m³
- 2009: 87,308 m³
- 2010: 93,734 m³
- 2011: 115,394 m³

Bar chart showing the increase in raw material used from 2003 to 2011.
### 4h. TMT: Manufacturer Numbers (data of 06/2012)

<table>
<thead>
<tr>
<th>Country</th>
<th>TMT Manufactures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>98</td>
</tr>
<tr>
<td>Canada</td>
<td>7</td>
</tr>
<tr>
<td>United States</td>
<td>10</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>12</td>
</tr>
</tbody>
</table>
4h. Wood Chips

- For heating, electrical, process heat (local use)
4h. Joint Marketing Opportunities

Bringing together the small craft producers such as: furniture, walking sticks, jewelry, etc. with a web based marketing effort to sell their products nationally.
4i. Regional Survey

- **Inventory Existing Industry**
  - "Survey for Opportunities"
    - Identify facilities for wood boiler placement
      - Southwest WI Boiler Study (2012)
    - Identify state and federal programs that could have a local impact

- **Consumer Survey**
  - See handout
5. Public Input

- Other ideas to help build the Kickapoo Valley Solid Biofuel and Wood Product Industry in a Sustainable manner