• Project overview
• Resource assessment
• Assess on-site electric and thermal applications
• Assess local/regional utility market
• Economic analysis
• Alternative products
• Evaluate and determine potential options for creating value-added products from the Tribe’s underutilized biomass resources

• Energy is primary focus

• Also looking at alternative products:
  – Liquid fuels
  – Pellets
  – Specialty wood products
  – Animal bedding
  – Others

• Work will be complete by the end of this year
Project Study Area

Area overview
• Quantify potential sources of biomass (primarily forest)
• Determine biomass availability
• Transportation infrastructure and costs
• Develop supply curves
Forest Cover

Source: Minnesota.data GIS. Minnesota Department of Natural Resources
## Forest Acreage and Annual Allowable Cut (AAC) by Type

<table>
<thead>
<tr>
<th>Cover type</th>
<th>Acreage</th>
<th>Annual allowable cut (cords)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reservation land</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspen/birch</td>
<td>98,710</td>
<td>36,625</td>
</tr>
<tr>
<td>Red &amp; White pine</td>
<td>10,364</td>
<td>3,253</td>
</tr>
<tr>
<td>Swamp Conifer</td>
<td>66,630</td>
<td>11,274</td>
</tr>
<tr>
<td>Swamp Hardwood</td>
<td>50,836</td>
<td>9,875</td>
</tr>
<tr>
<td>Upland Hardwood</td>
<td>33,561</td>
<td>1,698</td>
</tr>
<tr>
<td><strong>Total Forested Acres</strong></td>
<td>260,101</td>
<td>62,725</td>
</tr>
<tr>
<td><strong>Non-productive Acres</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Diminished Reservation Acres</strong></td>
<td>649,026</td>
<td>62,725</td>
</tr>
<tr>
<td><strong>Ceded land and Northwest Angle land</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forested Acres</td>
<td>83,354</td>
<td>17,727</td>
</tr>
<tr>
<td>Non-productive Acres</td>
<td>72,713</td>
<td></td>
</tr>
<tr>
<td><strong>Total Ceded and Northwest Angle land</strong></td>
<td>156,067</td>
<td>17,727</td>
</tr>
<tr>
<td><strong>Total Tribal forest land</strong></td>
<td>343,455</td>
<td>80,452</td>
</tr>
<tr>
<td><strong>Total Tribal land</strong></td>
<td>805,093</td>
<td>80,452</td>
</tr>
</tbody>
</table>

Acreage based on Operations Inventory (OPINV) data and AAC based on Continuous Forest Inventory (CFI) plot data from BIA.
Management History

CUTTING HISTORY
RED LAKE RESERVATION

From Annual Forestry Reports

- Much of pine forest destroyed through fires and illegal logging in 20th century
- Regeneration primarily in Aspen type the current commercial harvest species
- In 1980s Aspen harvest increased as OSB plants expanded operations
- Timber harvest less than AAC historically
- Even-aged management is predominant though all-aged used in hardwoods
# Wood Markets for Red Lake Band of Chippewa

<table>
<thead>
<tr>
<th>Species</th>
<th>Company</th>
<th>Location</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen</td>
<td>Ainsworth</td>
<td>Bemidji</td>
<td>Sawlogs for studs and OSB (pine)</td>
</tr>
<tr>
<td></td>
<td>Northwoods Panelboard</td>
<td>Bemidji</td>
<td>Panels</td>
</tr>
<tr>
<td></td>
<td>Boise Cascade</td>
<td>International Falls</td>
<td>Pulp</td>
</tr>
<tr>
<td></td>
<td>Blandin Papermill</td>
<td>Grand Rapids</td>
<td>Pulp</td>
</tr>
<tr>
<td></td>
<td>Champion International</td>
<td>Sartell</td>
<td>Sawlogs</td>
</tr>
<tr>
<td></td>
<td>StoraEnso</td>
<td>Duluth</td>
<td>Pulp</td>
</tr>
<tr>
<td>Red and White pine</td>
<td>Ainsworth</td>
<td>Bemidji</td>
<td>Sawlogs for studs</td>
</tr>
<tr>
<td></td>
<td>Sappi</td>
<td>Cloquet</td>
<td>Pulp</td>
</tr>
<tr>
<td>Paper birch, red maple, burr oak</td>
<td>Residential use</td>
<td>NA</td>
<td>Firewood (35,000 to 40,000 cords/year)</td>
</tr>
<tr>
<td>Northern White Cedar</td>
<td></td>
<td></td>
<td>TRIBAL RESOLUTION AGAINST CUTTING</td>
</tr>
</tbody>
</table>

Note: 80% goes to Ainsworth
~ 78,000 green tons unmerchantable biomass/year generated from forestry operations on reservation,
  - More will be generated when Tribe begins converting 1,000 acres/year to White Pine

Could generate 3-5 MW

Firewood delivered to Red Lake nursery for $50 cord (~$50/bdt) uncut in 8 foot lengths

Biomass costs will be in the $10-$20/GT ($20-$40/bdt) from good lands

Next steps
  - Develop supply curves showing cost and quantity of biomass
Demand (Energy Load Analysis)

- No large industrial facilities on the Reservation
- Sawmill shut down
- Entire Reservation load ~ 5 MW
- Electricity
  - Difficult economics
  - Requires capital, expertise, institutional arrangements
- Thermal
  - In many places, economics are often favorable
- CHP often favorable
• Local utility provider
• Adversarial relationship with Tribe
• Commercial rate ~ $0.06/kWh
• Residential avg. $0.062/kWh
  – Regional residential avg. $0.065/kWh
  – Beltrami ~5% lower
• National residential rate average $0.084/kWh
  – Beltrami ~26% lower
• Beltrami Electric Co-op purchases through Minkota
• Primary source is Milton R. Young Unit #1 & 2 (250 MW and 455 MW coal) (Center, ND)
• Two-year agreement with Potlatch for biomass power
• Winter peaking
• Very low avoided costs
• 2.2% forecast for annual growth
• Interruptible load important
• Will exercise Square Butte options in 2006-2009 to meet demand. Provides 95MW of baseload by 2009.
• DSM provides 340MW of control
• Next supply side option is peaking or firm hydro from Manitoba Hydro
• Operational
  – 368 MW (almost all at wood products companies)
• Potlatch OSB, Bemidji
  – 12.5 MW, sell power to Otter Tail
  – “free” fuel
• Planned
  – Fibrominn, 50MW, turkey litter
  – ~100MW to fulfill Xcel mandate
• Biomass legislative mandate
  – Closed loop provision
  – Difficult to address, (Itasca Power trying to build 15 MW plant for years)
  – 6 year window to allow for closed loop
  – Year 2000 “closure”
• Buy back rate for QF, ~$0.02/kWh
• Capacity payment, ~$25/kW-yr.
• IRP’s don’t mention biomass
• Legislative mandate toothless at this point
Economic Analysis of Power Generation
(Stoker=5MW; Gasifier= 3MW Net)
Comparative Costs of Electric Generation

- Gas CC (99)
- Coal
- Wind
- Landfill gas
- Gas CC (H)
- Geothermal
- Biomass Stoker @$20/BD
- Gas CT
- Solar CSP
- Biomass Gasifier @$50/BD
- Biomass Stoker @$50/BD
- Solar PV

All in Costs ($/kWh - no PTC)
Both retrofit and new opportunities

Technology is efficient and environmentally friendly

Need to assess
  – Competing fuel costs
  – Thermal loads (seasonality)
  – Existing equipment

Still looking at economics based on recent increase in oil prices
Local Comparative Fuel Costs

Cost of Local Heating Fuels

- Pellets: $7.17
- Biomass ($25/GT): $3.91
- Fuel Oil: $8.80
- Propane: $11.50
- Electricity: $18.17
- Off Peak Elec: $8.79

Note: Pellets = $86/ton delivered; Oil = $.95/gal; Propane = $.79/gal; Electric = $0.062/kWh; Off peak electric = $.03/kWh
• Evaluated all major buildings (schools, prison, administration, casino, meeting hall)

• Each building has challenges, including:
  – New facility and/or heating equipment, principally propane or fuel oil
  – Poor prior experience with cubed garbage
  – Competitive prices for propane and fuel oil

• No existing building has yet emerged as a strong candidate

• BUT……..Proposed tree seedling greenhouse is an ideal candidate
  – Not slated to be built until 2007
- Initially a good candidate
  - Large load
  - Hydronic system
  - Central facility
  - Plenty of space
- However,
  - Prior unsatisfactory experience with biomass = major resistance from maintenance staff
  - Almost new equipment and low propane prices make payback period fairly long
  - Energy efficiency measures have been successfully implemented
- Conclusion
  - HS is not a strong candidate absent rapid and prolonged increase in propane prices
Biopower is not presently competitive
  – Low cost existing producers
  – Regulatory landscape not favorable
  – Relatively high fuel costs

Thermal applications
  – Focus on new installations (e.g. new tree seedling greenhouse)
  – Still running the numbers on the hospital and a few other buildings given oil price increase
Other Products

- **Bio-Oil**
  - Emerging market
  - MN uses large quantities of fuel oil, as does Tribe
  - Applications not well defined as yet, primarily due to regulatory concerns and some technological considerations
  - Warrants a further look

- **Pellets**
  - Substantial overcapacity relative to demand in the industry
  - Would need to develop local markets for high ash pellet

- **Animal bedding material**
  - Potential candidate for utilization of Red Lake small diameter material
  - MN leading turkey producer
Shavings

- Product = wood shavings from low value biomass materials
- Possible constraint based on quality of the material
- Animal bedding for
  - Livestock
  - Laboratory animals
  - Small pets
- Ground cover at fairgrounds, circuses, rodeos, race tracks, livestock shows, etc.
- Compost, soil conditioner, mulch
- Fireplace logs
- Molded products (composites)
- “Green” packing material (meats, fruit, gifts, etc.)
Animal Bedding Markets

- Animal bedding is another potential biomass outlet
  - 222 poultry farms w/ 4,262 layers
  - 91 broiler farms w/ 3,038 broilers
  - 76 turkey farms w/ 659,383 turkeys
  - 354 dairy farms w/ 28,448 head
  - 1,428 horse farms w/ 8,917
- Higher end bedding markets for pets and laboratories could be more profitable
Substitutes (Competition)

- Shavings from urban wood waste
- Shavings from sawmills
- Sawdust (bedding)
- Newsprint, paper waste (bedding)
- Straw (packing, bedding)
- Styrofoam (packing)
• Biopower is not feasible at this time
• Explore heating the future (2007) seedling greenhouse with wood
  – We will begin preliminary assessment pending available design data
• Final look at additional heating opportunities
• Explore other products/markets until we find something with potential
  – Shavings
  – Bio-oil
    • thermal?
    • Co-fire with coal at utility boilers?
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