Community Based Wood Heat System for Fort Yukon

A Systems Integration
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Village Survival

Highest Energy Costs in Nation
Council of Athabascan Tribal Government

Alaska Village Initiatives

Original Goal: Displace as much diesel fuel as possible through development of a sustainable community based program
Highest energy costs in nation:
$6.00 per gallon of heating fuel
Heat School & Gym 30,000gals $180K
Run Generators = 200,000gals $1.4M

- $0.51 per kWh electricity
- $6.75 per gallon gasoline
- $7.00 per gallon heating fuel
- $200 per ton wood

$/MBTU

$149
$52.70
$46.30
$17.33
Subsistence Life Styles

Subsistence Resources:
Wood, Wildlife, Fish, Plant Products
Why Biomass as an Energy Source

Alaska has 1/7 of US Forest Lands

Source: AK Energy Authority

No Wind
Solar summer
Small Hydro

Objective:
Displace Diesel
Wood for Heat

Source: AK Energy Authority
Potential Biomass Energy

vs

Actual Alaska Energy Use

(in diesel gallon equivalents)

Source: AK Energy Authority
Community Wood Energy Program
More than an Energy Project

- Rural Economic Development
- Energy Cost Reduction
- Habitat Enhancement
- Environmental Improvement
- Wildfire Mitigation
- Village Survival
Community Based Sustainability

- Program: economically, socially/culturally, ecologically sustainable.
- System sustainability
Key Components of an Integrated Wood Energy Program

1. GIS based forest inventory and imagery
2. Sustainable 5-year harvest plan & support structure
3. Wood harvest, transportation and delivery equipment system functioning
4. District heat system design includes wood delivery and storage system functioning
5. Completing all environmental and permitting processes and compliance functioning
6. Timber Sales agreements – supply secured
Continued:

1. Energy sales agreement
2. Land Secured
3. Boiler operations functioning
4. Wood energy business model/plan functioning
5. Training and capacity building functioning
6. Technical support = training wheels funded
7. Hungry Boiler is Being Fed
For-Profit Wood Energy Business Model Fort Yukon

- Forest Management Service – CATG – TCC forestry
- For-Profit Wood Utility Company – Vertically Integrated
- Gwitchyaa Zhee Native Corporation
  - Wood Harvest
  - Village Wood Yard/Distribution
  - Wood Energy Utility = boiler operations
  - Wood diesel hybrid power plant - CHP – still looking for 100-400 Kwh technology
Heating Systems
Stick Fired

150,000 gal. displacement = 35 burns / day in 18 boilers
Heat Systems
Chip Boilers
Example district heating system

Fort Yukon
Boiler System

- Chip Fired 1600-2000 tons per year @ $175/ton
- Displace 150,000 Gallons per year in 15 buildings
- Project cost $3.0 million
- 14 year payback @ $4/gallon
- 6.5 year payback @ $6/gallon
Displacement of Fuel Oil, Local Economic Develop, Energy Self-Sufficiency & Sustainability

15 tons per acre

Summer 2005 Porcupine Burn 79,762-acre
Fire Driven Ecosystem
12MM acres statewide in 2004-2005
Typical Example of Seral Stages of Black Spruce Forest in Interior Alaska

3 Years Old  15 Years Old  43 Years Old  81 Years Old
Fort Yukon Biomass Resource Assessment

GIS layers:

Cover Types
GIS layers:

Site Class

- 0 - no woody biomass growth
- 1 - low site
- 2 - medium site
- 3 - high site
Fort Yukon Biomass Resource Assessment

Results:

Woody biomass tons/acre
## Results

### Biomass Stocking and AAC by Cover Type Class

<table>
<thead>
<tr>
<th>Cover Type Class</th>
<th>Acres</th>
<th>Standing Green Tons</th>
<th>AAC</th>
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<tbody>
<tr>
<td>Black spruce</td>
<td>395</td>
<td>860</td>
<td>56</td>
</tr>
<tr>
<td>Cottonwood poletimber</td>
<td>2,296</td>
<td>29,238</td>
<td>562</td>
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<tr>
<td>Cottonwood sawtimber</td>
<td>227</td>
<td>3,895</td>
<td>78</td>
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<tr>
<td>Hardwood poletimber</td>
<td>211</td>
<td>4,063</td>
<td>55</td>
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<tr>
<td>Mixed poletimber</td>
<td>3,773</td>
<td>105,010</td>
<td>1,631</td>
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<tr>
<td>Mixed sawtimber</td>
<td>281</td>
<td>7,516</td>
<td>150</td>
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<tr>
<td>Reproduction</td>
<td>8,155</td>
<td>0</td>
<td>1,223</td>
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<tr>
<td>White spruce poletimber</td>
<td>7,853</td>
<td>229,971</td>
<td>4,134</td>
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<tr>
<td>White spruce sawtimber</td>
<td>2,639</td>
<td>82,404</td>
<td>1,627</td>
</tr>
</tbody>
</table>

Totals: 25,829 462,958 9,517
Acreage Harvested for Heating

- 2,000 tons / year heat
- 25 tons/acre
- 40 year rotation
- 80 acres / year
- 3200 acres / rotation
- Moose habitat for 20 years
- Historical wildfire events have burned 80,000 acres in one month
Proposed Rural Wood Fuel Supply System

• Capital costs for system capable of producing 7,000 TPY: $600,000
Key Obstacles to Overcome

- Development of program understanding/support:
  - Community
  - Funding agencies
  - Political support
- Local Capacity to own and operate the full business model
- Creating the correct incentives/model in each village
- Scaling the hardware & systems to meet local conditions
- Keeping the training wheels on long enough = funding
Accomplished to Date Fort Yukon

- Community Support
- Forest Stewardship Completed
- Transportation and equipment study completed
- GIS based inventory completed
- 35% boiler modeling completed with powerhouse
- EA in progress
- Conceptual Design Study to link Powerhouse in progress
Next Steps

- Just hired a project liaison – Randy Engler
- Build confidence of funders
- 5 year wood harvest plan in progress
- Business plan in progress
- 65% design in progress
- Start construction of boiler
- Start wood harvesting
Lessons Learned

- Perseverance – Thanks Lizana
- Keep a Champion from the Village out front – Thanks Randy
- Integration – Integration- Integration
Funding Partners

- USDA NRCS
- DOE Tribal Energy Program
- Denali Commission
- Alaska Energy Authority
- Division of Forestry – DNR
- USDA Rural Development
- State and Private Forestry – USFS