Council Of Athabascan Tribal Governments (CATG) : Fort Yukon Wood Energy Program – Wood Boiler Deployment (AK)

Presented by :
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## Yukon Flats

- 10 Athabascan villages in the Yukon Flats
- 8 Gwich’in villages and 2 Koyukon villages
- 55,000 sq. mi. Size of Wisconsin
- 1500 people
- Fort Yukon largest Hub Village 650 people
- Smallest Village Birch Creek 25 people
- Fort Yukon and Circle are the only villages with a City Government
- There is no organized Borough in the Yukon Flats
- Two villages on road system
Yukon Flats- Fall Season
Our Tribal Organizations

- **GZGTG**
  Gwichyaa Zhee
  Gwichin Tribal Government *formally known as the Native Village of Fort Yukon*

- **CATG**
  Council of Athabascan Tribal Government is an consortium of 10 Gwichin/Koyukon Villages

- **GZC**
  Gwitchyaa Zhee Corporation ANCSA Village Corporation
Overview of Project:

- Off Road system biomass CHIP
- New Power House (CHP) Facility construction
- Wood Chip Boiler
- District Heating loop providing heat to commercial buildings
- (6-10 buildings) I.e. School, Radio Station, Water Plant, etc.
- Sustainable Forest Management program
- Create a for profit in-village wood energy utility to displace diesel energy
- Support training needs for field forestry technicians and supports workshops for education on key biomass issues for Fort Yukon and the Yukon Flats Villages
Fort Yukon Combined Power & Heat
David Lee Thomas Building
Fort Yukon, AK
Open house day

The town came to see the new facility!! Nov 2017
Fort Yukon District Heat Loop
Installing District Heat Loop with Arctic Pipes, this was installed over the ANTHC’s water-sewer infrastructure.
The District Heat loop arctic piping is PEXa (a high tech plastic commonly used in hot water heating systems). Unlike steel or copper pipe, 200+F hot water approaches the upper temperature limit of PEX. Operating at 200+F temperature for extended periods of time will degrade the PEX (kind of like a car dashboard in the desert - which can crack due to exposure to heat and sun).

To verify that PEX pipe would work for the GZUC district heat system, provided a computer analysis of the temperature profile and verified it complies with their 25-year warranty requirements. Below is the Sequence of Operations for the District Heat system control panel. When the outside air temp is 55F and above, the district heat supply set point is reduced to 160F. When the outside air temp is below -30F, the district heat supply set point is increased to 190F. When the outside air temp is below -30F, the district heat supply set point is increased to 190F.

**NOTE:** there is not sufficient heat available from the diesel heat recovery system alone to provide a 190F supply temperature at -30F, so unless the boiler is operating, the DH supply temperature will be depressed to around 170F+/- . With the boiler operating, 190F supply temperature should be adequate to meet the heat demand of most end-users. Once the boiler is operating, minor set point adjustments can be made to optimize the district heating system operation.

**THE DISTRICT HEAT CIRCULATING PUMP P-DH2 WILL OPERATE CONTINUOUSLY UNDER VARIABLE FREQUENCY DRIVE CONTROL WITH A MINIMUM PUMP SPEED OF 10HZ, ADJUSTABLE. THE P-DH2 VFD WILL MODULATE SPEED TO MAINTAIN DISTRICT HEAT SUPPLY TEMPERATURE RELATIVE TO OUTSIDE AIR (OA) TEMPERATURE ACCORDING TO THE FOLLOWING SCHEDULE (NOTE DEADBANDS):**

- **SUPPLY TEMP = 190F WHEN THE OA TEMP IS -30F OR COLDER**
- **SUPPLY TEMP = 185F WHEN THE OA TEMP IS -20F TO +10F**
- **SUPPLY TEMP = 180F WHEN THE OA TEMP IS +20F TO +45F**
- **SUPPLY TEMP = 160F WHEN THE OA TEMP IS +55F OR HOTTER.**
Kob Pyrotec Boiler

Our Biomass Chip Boiler !!!

1. Feed auger (with light barrier)
2. Burner trough with internal grate
3. External grate
4. Moving annealing grate
5. Secondary air flow
6. Ignition fan
7. Deashing system
8. High-temperature burnout zone
9. Combustion chamber door
10. Triple-pass heat exchanger
11. Safety heat exchanger
12. Pneumatic pipe cleaning system
Biomass Boiler arrival via Local Barge Company on the Yukon River, 2017
Boiler Delivered to the CHP site from the Barge Sept 29, 2017
The manufacture did not get the boiler loaded onto the barge in Austria, was delayed a month, which created a domino effect with all the other logistic planning.
Boiler inside the bay
Our boiler at the site in boiler bay
Biomass Boiler Stack installed
Continued construction work for the Chipper Bay
Our above-the-Arctic-Circle-Style Chipper Bin beginning construction
A lesson learned: we needed more wall protection in the chipper bay than the design called for, we had to negotiate and got the wall protection for lasting effect.
The opening to move the chips to the from the moving floor to an auger to convey directly to the biomass boiler
The chips will drop from the chipper trailer, into this chipper bin, the floor will move the chips on to a conveyor to the boiler. Laser eyes to monitor the chipper levels.
CHIPPER TRAILER ARRIVAL
We will back the chipper trailer in the bay up to the chipper bin. The moving floor will push the chips out of the trailer into the chipper bin.
Awe realized we needed to modify the rear of the chipper trailer, so we could chip directly into the trailer bin to transport to the power plant to connect chips into the chipper bin which will feed the biomass boiler.
Chipper door added so we could chip directly into chipper trailer.

- Minor modifications made after design process
Fuel Conveyance Systems

The standard chip bin with hopper to feed the boiler...but, above the Arctic Circle, we must modify to be in compliance.
MOVING FLOOR & HYDRO LIC S Chipper Trailer
With the chipper trailer in:

- Connecting hydraulics
- Laser lines provide fill sensors
Getting the Biomass Chips

The Kubota grabs the wood product
To feed the Chipper at the chipping site

The Chipper then fills the chipper trailer
The Chips are fed to the boiler

The BOILER gets commissioned
April 6, 2018  Biomass Boiler Commissioned!!!
The Biomass Boiler Stack is going!!
THE HEAT LOOP HAS A READING OF 180 degrees GOING OUT OF THE CHP & A RETURN OF 165 degrees.

WHEN TEMPS DROP TO MINUS 20 degrees, WE WILL NEED THE BIOMASS BOILER to KEEP THE HEAT LOOP TEMP UP.

- THE Pyrotec 390, requires at least 35% Moisture Content
- Our Poplar Wood Harvest has been drying for 3 years
- We will have to Harvest Birch as Galena, AK is doing
Design Considerations

- 4-Bay Generator Power Plant
- w/ 2 Detroit Diesels and 2/35.08B CAT
- Biomass Bay, Biomass Chipper Bay & Garage
- 20,000 gallon fuel tank
- 14 days + 5-day fuel reserve at peak loads
- District Heating System to Serve 7-10 Commercial Buildings
Design Accomplishment

- Displaced 100,000 gallon diesel per year
- Forestry Management Plan
- Harvest Plan
- Allows energy monies to stay in the community

Future Expansions
- Use the chip boiler set up with remote sites
- Share this knowledge with surrounding communities
Integrated Biomass Program

- Rural Economic Development
- Energy Cost Reduction
- Wildfire Mitigation
- Habitat Enhancement
- Environmental Improvement

Community Biomass Utilization Program
Grants / Bookkeeping

- RUS USDA
- DOE Tribal Energy
- AEA REF
- REAP USDA
- 3rd Party Accounting
Our chip site, we will cross water ways to our harvest site upon freeze up so the equipment can cross safely.

Must cross this Yulotta Slough
Equipment Training New Holland Tractor and Kubota

Kubota Training:
- Cutting and Loading Capabilities
- Maintenance
- Falling Debris
- Proper timber cutting layout

New Holland Training:
- Safety
- Maintenance
- Proper functions, in the woods and around other machinery and hazards
- Proper log skidding techniques
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<thead>
<tr>
<th>Lessons Learned</th>
<th>Activities Yet to be Completed</th>
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<tbody>
<tr>
<td>Be Vigilant</td>
<td>Complete Heat Sales Agreement W City</td>
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<td>Monitor the overall project Budget</td>
<td>Update Heat Utility Business Plan.</td>
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<td>Be willing to stop project to Get the updates &amp; answers</td>
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<tr>
<td>Always &amp; Always check the Weather!</td>
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For-Profit Wood Energy Business Model Fort Yukon

- Forest Management Service - CATG
- For-Profit Wood Utility Company - Vertically Integrated
- Gwitchyaa Zhee Native Corporation
  - Wood Harvest Company
  - Village Wood Yard/Distribution Company
  - Wood Energy Utility - Diesel Biomass
  - Wood diesel hybrid power plant CHP – still dreaming for 200 – 700 Kwh technology
Once a program has been established in Fort Yukon, it is the intent of CATG Natural Resource Department in collaboration with the Village Tribes, Native Corporations and Private Lands to support the installation of programs in each of the villages in the Yukon Flats Region. The model program being developed in Fort Yukon will serve as the basis for all projects in interior Alaska.
Fort Yukon’s new Combined Heat and Powerhouse (CHP)
FORTYUKON CHP STARTED DIESEL ELECTRICAL GENERATION DEC 2016

BIOMASS BOILER INSTALLATION END OF NOVEMBER 2017

COMMISSION BIOMASS BOILER April 2018
Fort Yukon’s Old Power Plant
Mashii Choo for the new CHP and Biomass System for Fort Yukon & the Yukon Flats
Questions & Answers