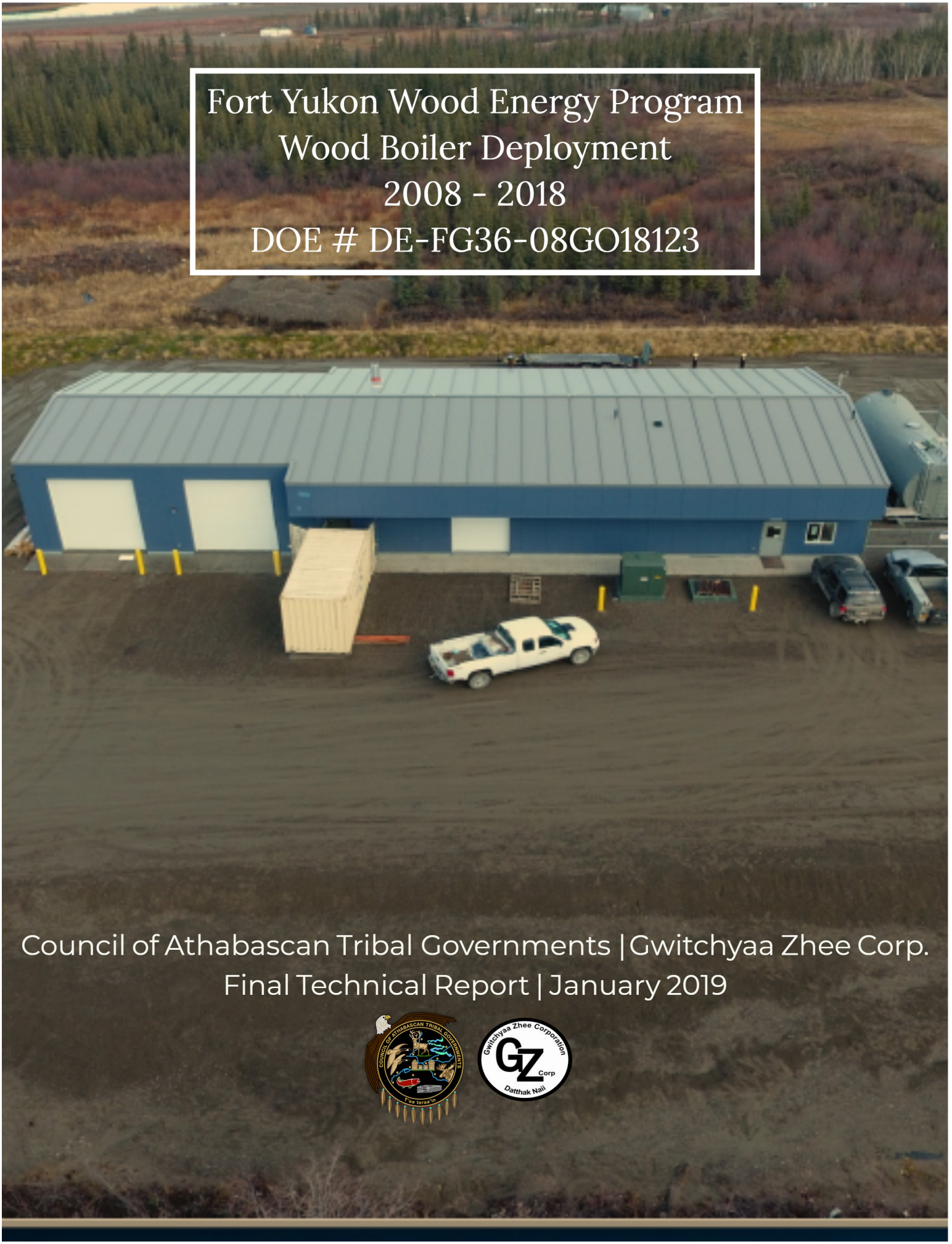
# Fort Yukon Wood Energy Program
# Wood Boiler Deployment
# 2008 - 2018
# DOE # DE-FG36-08GO18123



Council of Athabascan Tribal Governments | Gwitchyaa Zhee Corp.

Final Technical Report | January 2019

**Fort Yukon Wood Energy Program: Wood Boiler Deployment**

**Council of Athabascan Tribal Governments**

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**Fort Yukon Wood Energy Program: Wood Boiler Deployment**

**Council of Athabascan Tribal Governments**

## Executive Summary

The Fort Yukon Gwitchyaa Zhee Corporation (GZ) worked with partners on the development of an Integrated Biomass Energy Program for Fort Yukon. This integrated approach linked sustainable forest management with an in- village for -profit wood harvest and delivery business to displace diesel energy with wood energy for heat and power. The program was based on the concept of ecological, economic and social sustainability with a goal of displacing as much diesel and fuel oil as is technically feasible and sustainable; essentially systematically converting a village to significant amounts of wood use.

Additionally, GZ worked with the Alaska Energy Authority (AEA) on the development of a rural power system upgrade (RPSU) project that replaced GZ's existing antiquated diesel power plant and provided upgrades to the existing electrical distribution system. Due to the synergy of the two projects, the Biomass and RPSU projects were combined to provide improved operating efficiency, economy of scale and increased benefits to GZ, the Council of Athabascan Tribal Governments (CATG) and the community of Fort Yukon. The combined project is referred to as the Fort Yukon Combined heat and power (CHP) project.

The purpose of the DOE Tribal Energy Program award was to support the preconstruction tasks and installation of wood boilers at the CATG clinic, and at the new GZ diesel power plant as part of an overall program to create a for- profit wood energy utility in Native Village of Fort Yukon. The CHP project provides biomass and diesel generation recovered heat via a new district heating system to the major commercial buildings in Fort Yukon. The CATG clinic will receive heat from a separate biomass boiler to their heating needs.

The award from the Department of Energy (DOE) Tribal Energy Program was divided into two phases: Design/Permitting (phase 1) and Construction (phase 2). Phase 1 (Design & Permitting) is cost shared using State of Alaska Renewable Energy Funding (REF) funds through the Alaska Energy Authority (AEA). Phase 2 (Construction) was funded by DOE, AEA and US Department of Agriculture Rural Utility Service (USDA-RUS). Phase 1 of this grant, along with a separate grant from the Denali Commission provided funding for development of the wood delivery infrastructure necessary to support the CHP project.

Under phase 2, This DOE grant supported final design of the boiler, bidding, purchase and transport of boilers, installation, technical support and engineering. The AEA and RUS grants supported permitting, final design, material and equipment purchase, and construction and installation of the new diesel power plant and district heating distribution system.

**Fort Yukon Wood Energy Program: Wood Boiler Deployment**

**Council of Athabascan Tribal Governments**

**Project Overview**

## Background

The Council of Athabascan Tribal Governments is a consortium of ten Gwich'in and Koyukon Athabascan tribes settled in 10 remote villages and are linked by the Yukon River system. The region is transected by the Arctic Circle and encompasses an area of approximately 55,000 square miles (about the size of Wisconsin ). Approximately 1,700 people inhabit this sub-arctic landscape. The region is rich in forest resources, but the Tribes face a daily struggle to meet their communities energy needs. Village power systems are diesel generators. These diesel generators vary in efficiency, quality, and dependability. Most major buildings are heated with fuel oil boilers. Energy production costs are soaring since diesel must be flown or barged in to each community. In Fort Yukon unsubsidized residential electricity costs 65 cents per kilowatt hour compared to 8.5 cents per kilowatt in Fairbanks. CATG is currently developing a region-wide energy plan through an Environmental Protection Agency (EPA) grant with the primary goal: to empower Yukon Flats Tribes to work collaboratively to satisfy community energy needs while re-investing in communities, promoting economic development, and ensuring environmental integrity.

CATG has been working for ten years in support of the development of a model integrated Biomass Energy Program and economic development support functions for Fort Yukon. This integrated approach links sustainable forest management with an in-village wood energy utility to displace diesel energy in Fort Yukon with incredibly high-energy costs. CATG has been working to support development of a business model, feasibility studies, and specifically develop a Forestry Management Program that includes Geographic Information System (GIS) and a forest management plan, to support training needs for field forestry technicians and support workshops for education on key biomass issues for Fort Yukon and the Yukon Flats Villages.

A key to success for a biomass energy and economic development project of this magnitude in a remote village is to develop the wood supply infrastructure, which is the harvest system and wood yard, simultaneously with the infrastructure for conversion of biomass to heat. The Gwitchyaa Zhee Corporation has a Denali Commission grant to cost share on the wood delivery infrastructure. This project specifies that the DOE Tribal Energy Program is to cost share specifically on the engineering, purchase and installation of biomass boilers at the CATG clinic and the CHP facility. The goal is to displace up to 90% of the fuel oil used at the buildings connected to the district heating network. A secondary benefit of the wood yard will be the

supply of split firewood for home heating, and in conjunction with an education program, will spur household investment in more efficient and environmentally sound wood burning technology.

Once a biomass delivery program has been established in Fort Yukon, it is the intent of CATG Natural Resources Department, in collaboration with the Village Tribes and Doyon Native Corporation, to support the development of biomass heat programs in each of the villages of the Yukon Flats Region. The model program being developed in Fort Yukon will serve as the basis for other biomass projects in the Interior of Alaska. Several funding sources have supported the development of the program to date. Natural Resources Conservation Service funding helped Alaska Village Initiatives (AVI) develop the conceptual design of an integrated biomass program as described above. Funding from Alaska Department of Natural Resources Forestry Department supported development of the program to date. National Resources Conservation Service (NRCS) funding helped AVI develop the conceptual design of an integrated biomass program as described above. Funding from Alaska Department of Natural Resources Forestry Department supported the development of a Forest Stewardship Plan which demonstrated the potential of local forests to supply sustainable biomass from GZ lands and a Rural Business Enterprise Grant supported the refinement of a business model for development of the harvest.

The purpose of this funding award is to support the preconstruction tasks and the installation if wood boilers at the CATG Clinic and CHP facility as part of an overall program to create a for-profit wood energy utility in Fort Yukon. The award from DOE Tribal Energy Program is divided into two phases and is cost shared with Alaska Energy Authority funding. For simplification of contracting, certain components of the project have been allocated to one funding source; however, all tasks are considered a complete package of the project. The first phase is pre-construction. Phase 2 is construction.

Key Program Components for an integrated process include:

- Forest Management Program;
- For-Profit Wood Harvest System;
- For-Profit Wood Yard Processing and Delivery System;
- Purchase and Installation of wood boilers for the CATG Clinic and the CHP facility;
- Technical Support and Training for each component over the life of the project.

## Fort Yukon Wood Energy Program: Wood Boiler Deployment

## Council of Athabascan Tribal Governments

# PROJECT OBJECTIVES

The overall objective of the project is to establish a wood energy program that will reduce use of fossil fuel for heat by up to 90% in major facilities. The concept design developed for the project estimates a diesel heating fuel reduction of approximately 80,000-gallons for the thirteen buildings connected to the CHP district heating system, and an additional 8,000-gallon for the CATG Clinic. This would result in a diesel fuel savings of $440,000 annually, based on a conservative wholesale diesel fuel cost of $5/ gallon.

The project objective with the Department of Indian Energy Thus funding was used to continue support for the development and construction of a biomass diesel hybrid Combined Heat and Power District Heating Plant in Fort Yukon, Alaska. The funding focus is on the development of an 80% design for plant construction and development of a biomass harvest strategy to support a wood-chip fire boiler system in the community.

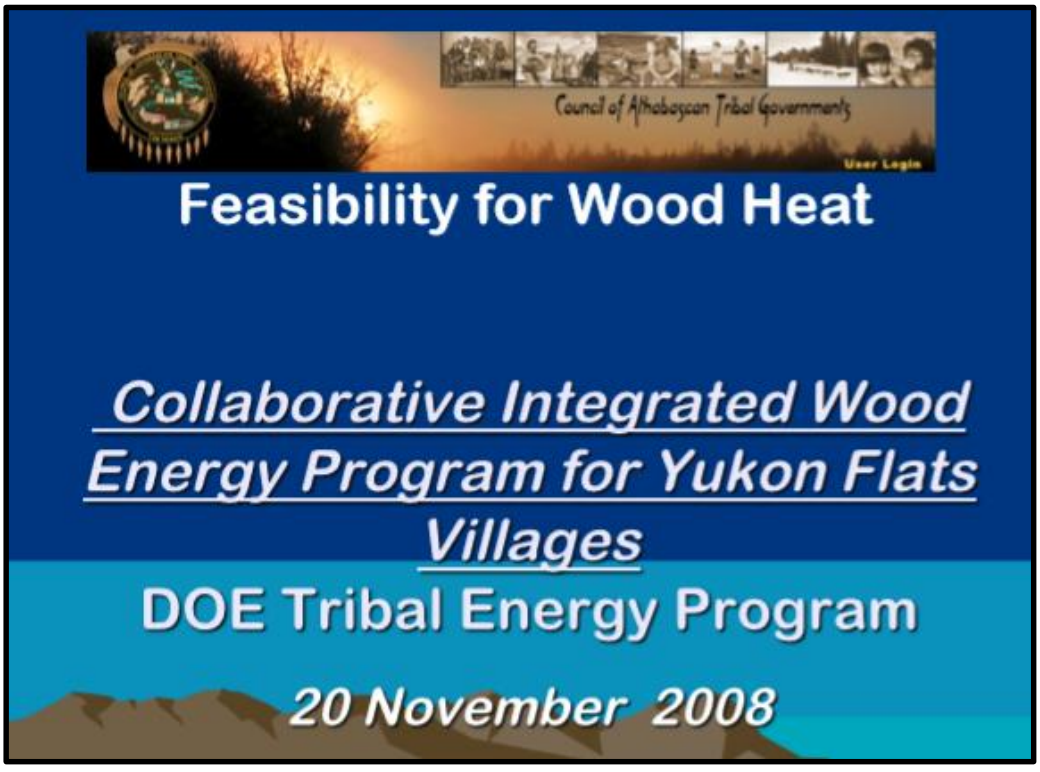
**Fort Yukon Wood Energy Program: Wood Boiler Deployment**

**Council of Athabascan Tribal Governments**

# ACTIVITIES PERFORMED

## 2008 SEEKING FUNDING PARTNERS

- USDA Natural Resources
- DOE Tribal Energy Program
- Division of Forestry - DNR
- Denali Commission
- Alaska Wood Energy Development Task Group
- Alaska Energy Authority
- USDA Rural Development
- State and Private Forestry
- DOE Tribal Energy/GZ/CATG/AWEA, A Collaborative Integrated Wood Energy Program of Fort Yukon, Implementation Plan - 11.20.2008
- Feasibility for Wood Heat, A Collaborative Integrated Wood Energy Program for Yukon Flats Villages - 11.20.2008




## Council of Athabascan Tribal Governments (CATG)

- Non-Profit Consortium of Ten Tribal Governments within the Yukon Flats.
- CATG Administers several Tribal Programs on behalf of the Tribes.
- CATG also applies for and administers several other grants.
  - **IHS**, Regional Clinic (Fort Yukon), Health Aids in Each Village, drug and alcohol programs, and other health related programs.
  - **Natural Resources**, EPA/IGAP, ANA (Traditional Land use Planning and Mapping), GIS, USDA RC&D, Contracts/Compacts with the USF&W (first tribal entity in U.S.), and many other NR related projects.
  - **Education**, NACTEC, NAVTEP, Early Head Start, Facilitate/ Cooperate with UAF on other education programs.

## Gwichyaa Zhee Gwich'in Tribal Government (GZGTG)

**Federally recognized tribe 1200+ Tribal Members. Administers all 638 tribal programs and many other grants to include:**

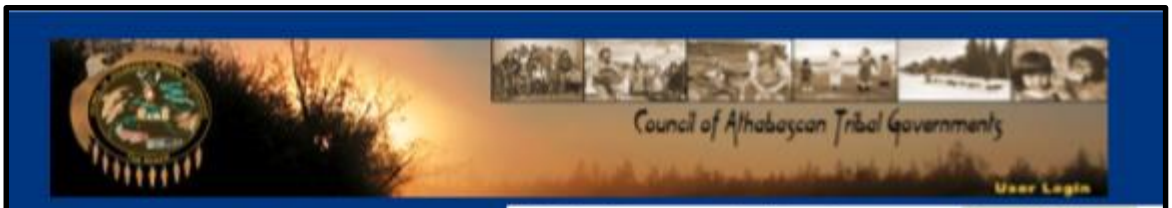
**Natural Resources, Realty, ICWA, General Assistance, Education/ Employment, Elders Nutrition, Forestry, Fire Management, Self-Governance, Economic Development, Tribal Operations, EPA/IGAP and many other programs and grants.**

## Gwitchyaa Zhee Corporation (G.Z. Corporation)

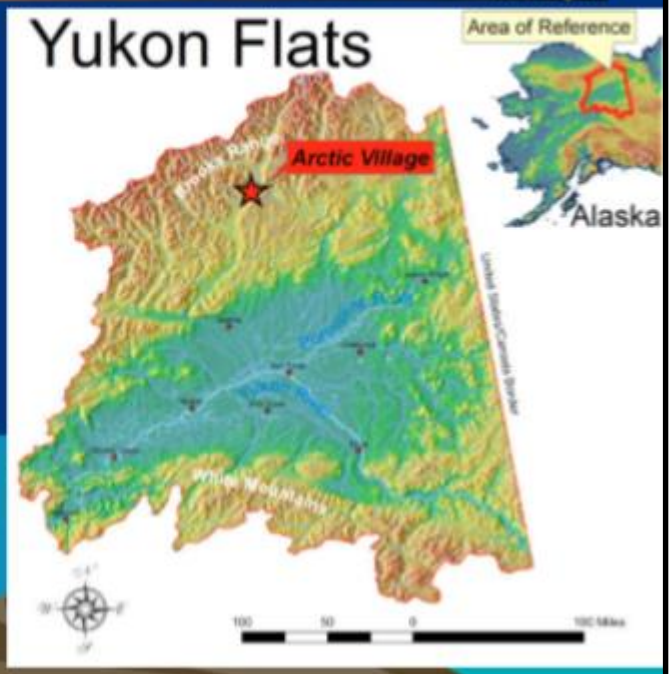
**For-profit organization formed under the Alaska Native Claims Settlement Act (ANCSA) 1971. G.Z. is the village corporation, under ANCSA they also created 13 Regional Corporations, ours is Doyon Inc. G. Z. has 600+ shareholders, not all tribal members are shareholders, because the corporation hasn't voted to enroll children born after 1971.**

**Some of the economic projects the corporation has:**

**Fuel Station, rental buildings, land leases, 7i funds, mutual funds, gravel sales, timber sales, and hopefully Bio-mass.**

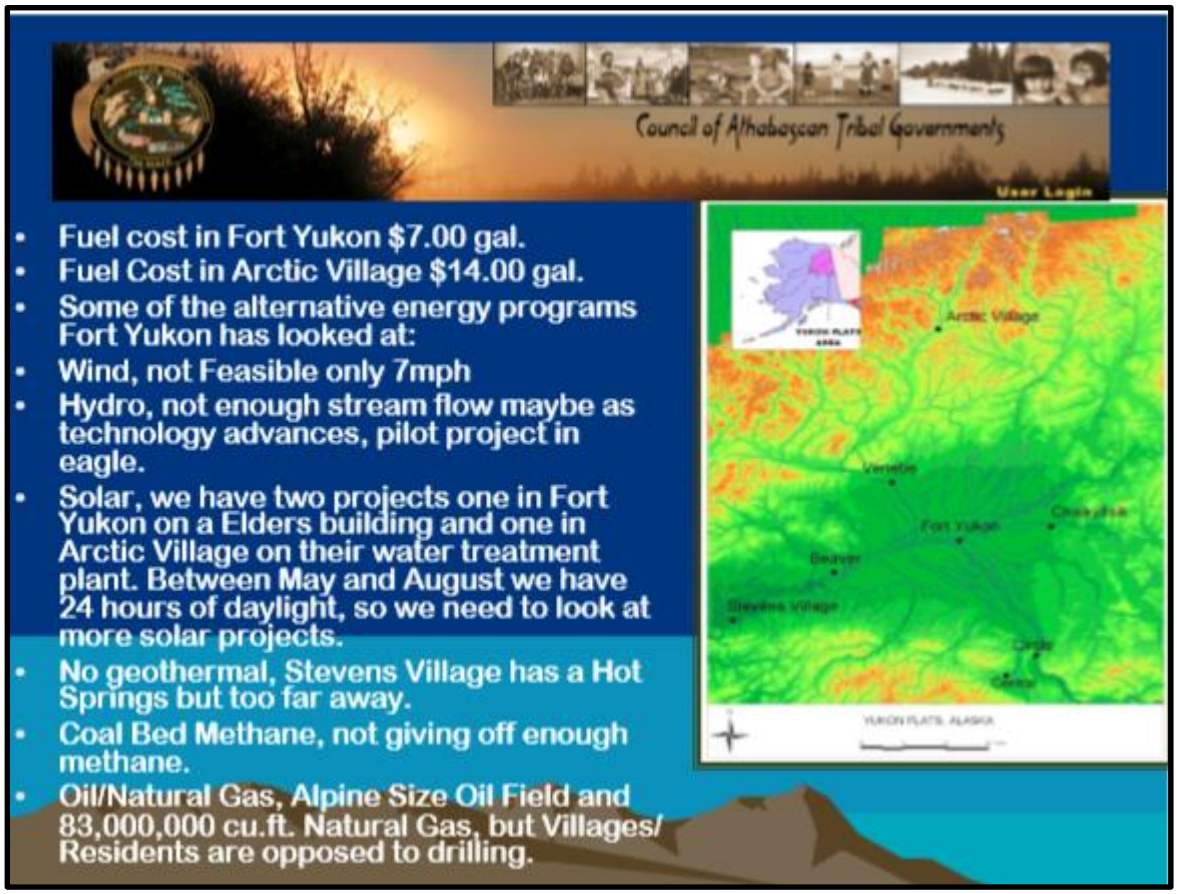



- 10 Athabascan villages in Yukon Flats
- 8 Gwich'in villages and 2 Koyukon villages.
- 55,000 sq. mi. Size of Wisconsin.
- 1500 people
- Fort Yukon largest Hub Village 650 people.
- Smallest Village Birch Creek 25 people.
- Fort Yukon and Circle are the only Villages with a City Government.
- There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

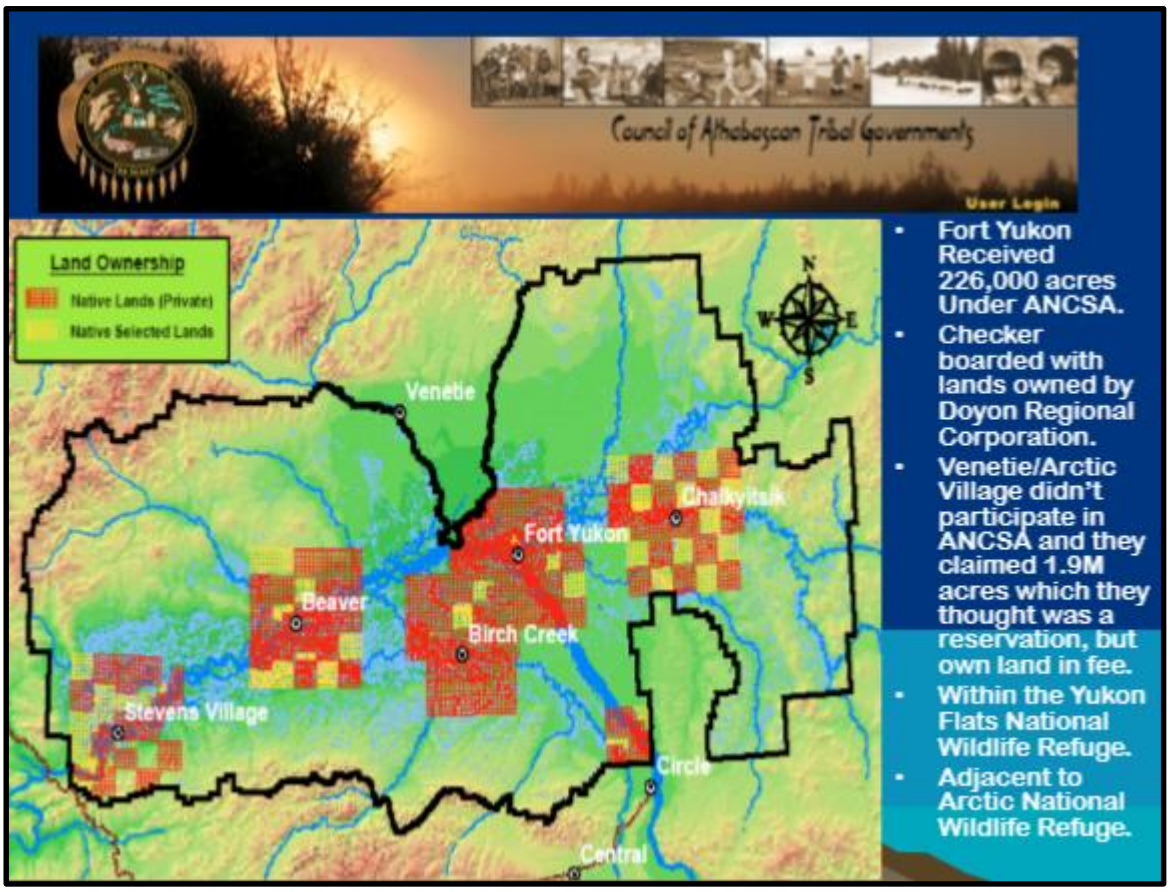




- All electricity is generated by diesel.
- 4 villages have to fly fuel in, no barge service.
- 2 villages cut their generators off at 10 pm and back on again at 8am. Venetie and Arctic Village.
- One Village has Pre-paid Meters. Chalkyitsik
- 80% of homes in Fort Yukon are heated by wood. Most use wood and fuel heat.
- All other villages heat by wood with a few that use fuel. All Village buildings are heated by fuel.
- Fort Yukon is only village that has piped water and is currently installing piped sewer.
- Chalkyitsik and beaver has some piped water and are developing septic tanks. All other villages have to haul own water and use honey buckets and outhouses. All Village Schools have running water and sewer.
- All villages have a washeteria where they get their water, shower, and wash clothes.




- Fuel cost in Fort Yukon $7.00 gal.
- Fuel Cost in Arctic Village $14.00 gal.
- Some of the alternative energy programs Fort Yukon has looked at:
- Wind, not Feasible only 7mph
- Hydro, not enough stream flow maybe as technology advances, pilot project in eagle.
- Solar, we have two projects one in Fort Yukon on a Elders building and one in Arctic Village on their water treatment plant. Between May and August we have 24 hours of daylight, so we need to look at more solar projects.
- No geothermal, Stevens Village has a Hot Springs but too far away.
- Coal Bed Methane, not giving off enough methane.
- Oil/Natural Gas, Alpine Size Oil Field and 83,000,000 cu.ft. Natural Gas, but Villages/ Residents are opposed to drilling.




- Fort Yukon Received 226,000 acres Under ANCSA.
- Checker boarded with lands owned by Doyon Regional Corporation.
- Venetie/Arctic Village didn't participate in ANCSA and they claimed 1.9M acres which they thought was a reservation, but own land in fee.
- Within the Yukon Flats National Wildlife Refuge.
- Adjacent to Arctic National Wildlife Refuge.

# Subsistence Life Styles

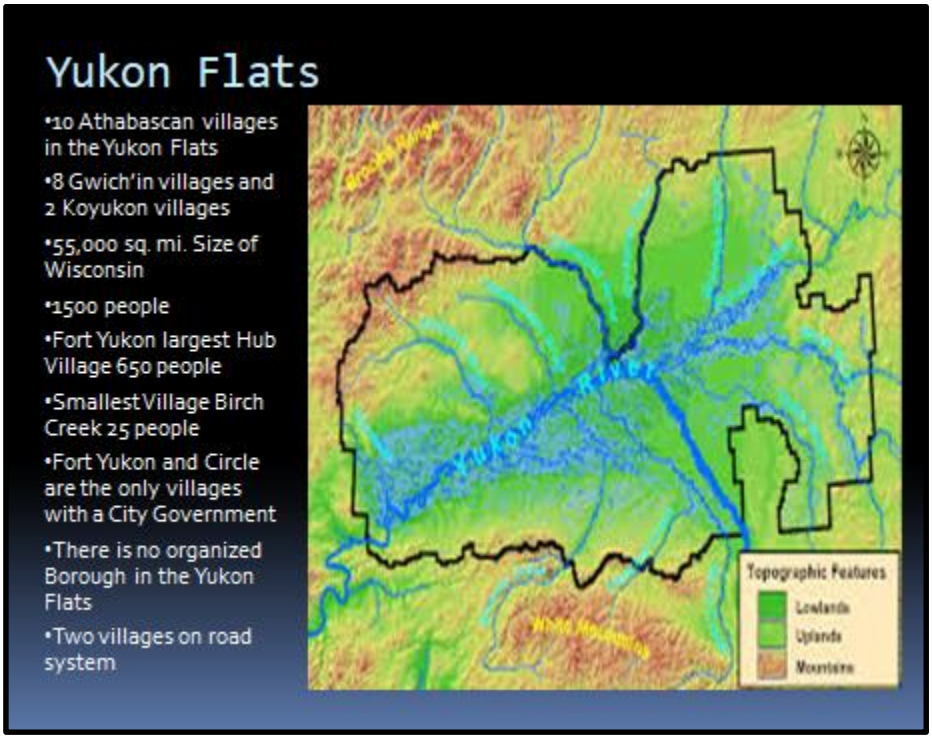
**Subsistence Resources:**

Moose, Caribou, Dall Sheep, Black Bear, Brown Bear, Wolves, Beaver, Muskrat, Otter, Fox, Salmon (Chinook, Coho, summer and fall Chum), White Fish, Sheefish, Pike, lake trout, grayling, Grouse, Spruce Hen, Waterfowl from 5 different countries, blueberries, raspberries, rosehips, wild onions, rhubarb, and many other natural resources that we utilize and depend on

**Bio-Mass is not a new concept to the Yukon Flats. We Currently Utilize wood for Heating our Homes and back in the Steamboat Days we sold cordwood to power the steamboats.**

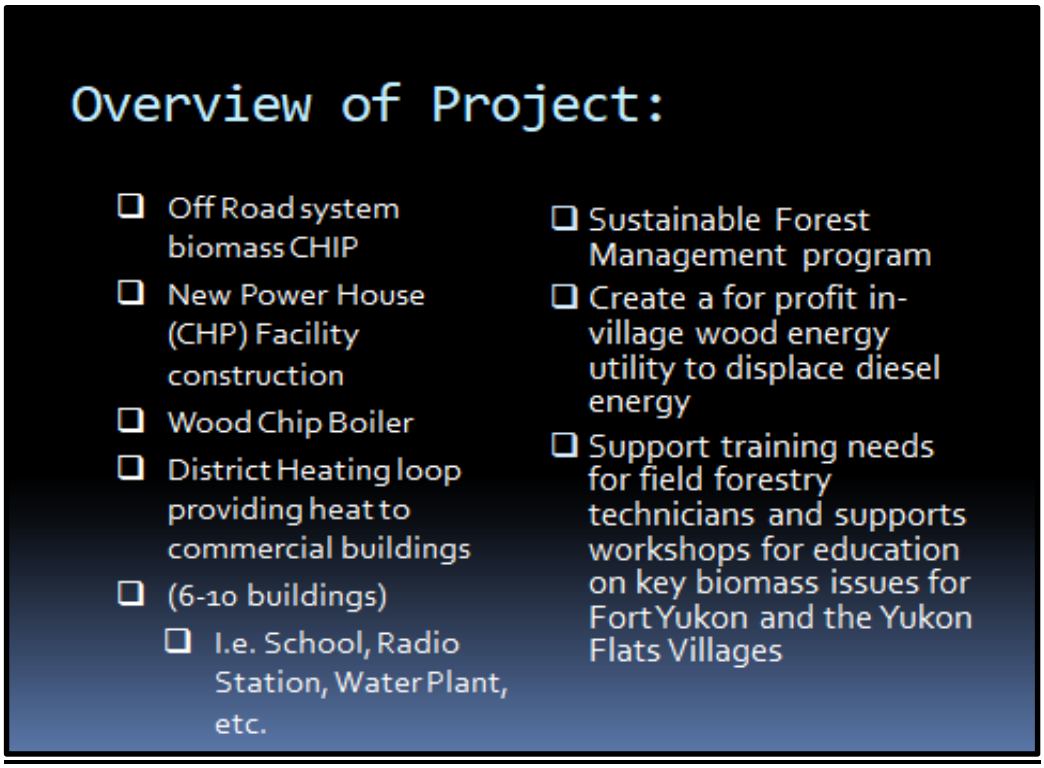
People meeting a steamboat


*Feasibility for Wood Heat PowerPoint Presentation 11/20/2008, CATG Natural Resource Dept.*



## Tribe

- Gwichyaa Zhee Gwichin Tribal Government formally known as the Native Village of Fort Yukon
- Council of Athabascan Tribal Government is an consortium of 10 Gwichin/Koyukon villages
- Gwitchyaa Zhee Corporation ANCSA Village Corporation




## 2009 WOOD ENERGY PROGRAM SCALES OF PENETRATION

- Village Scale - Created a Wood Energy Utility
- Commercial Buildings - Economic driver
- Households - secure relativity
- Inexpensive consistent supply
- Local management - Capacity Building
- Central Conceptual Design for Chalkyitsik Biomass, completed
- Heating Conceptual Design for Venetie Biomass, completed

## 2010 GARNERING COMMUNITY SUPPORT

- Community Support Meetings
- 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

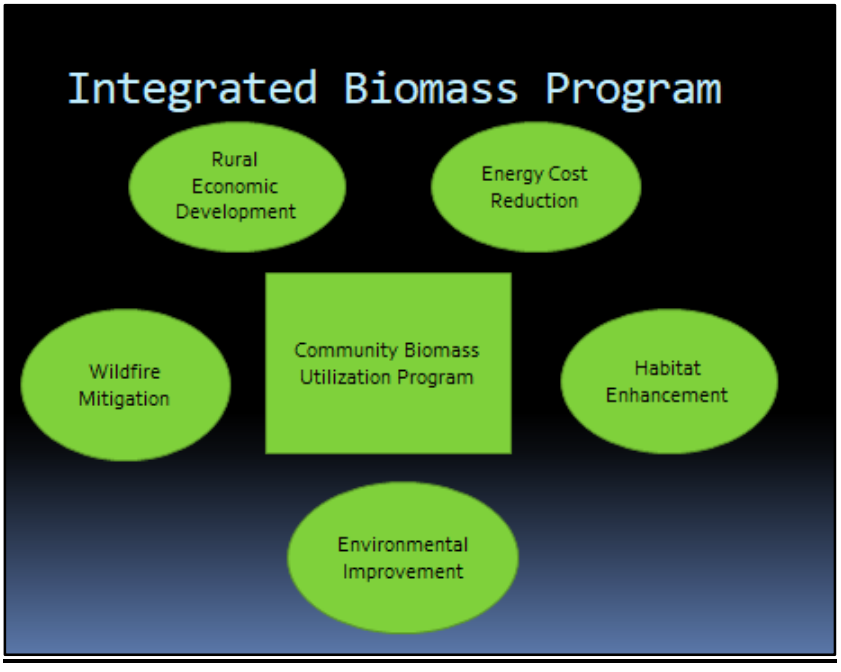
## 2011 DEVELOPED IMPLEMENTATION PLANS

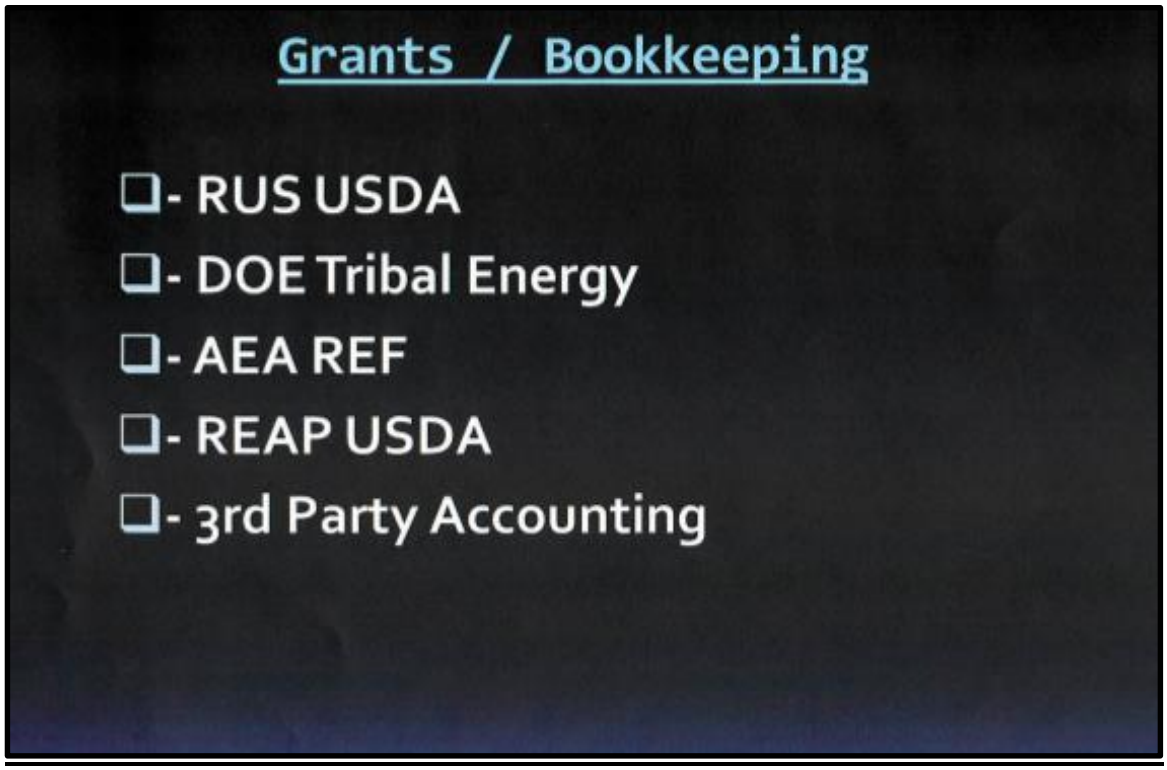
- Environmental Assessment for a Combined Power & Biomass Heating System, March 2011
- Business Operating Plan, Fort Yukon Combined Heat & Power Project
- Fort Yukon Woody Biomass Fuel Implementation Plan
- Implementation Plan:  Harvest Area completed
- Implementation Plan:  Harvest Equipment completed
- Wood Energy Deployment Meeting, Anchorage, AK - 8.24.2011
- Biomass Meeting with Venetie Tribe - 9.2-4.2011
- Biomass Project Presentation, Anchorage, AK - 9.21-24.2011


*04/11/2011 Planning meeting attendees:  Previous CATG Natural Resource Director James Kelly Sr., & Beloved Gwichyaa Zhee 1st Chief Adlai Alexander*

## 2012 FUNDING SECURED

- Denali Commission & Alaska Energy Authority - Harvesting Equipment $808,805
- Alaska Village Initiatives - Training & Technical Support & Harvest Plan $258,300
- Denali Commission, Alaska Energy Authority - Comprehensive Energy Business Plan including Power House System Upgrade (1st Draft completed) $60,000
- Alaska Energy Authority - Final Designs funds $210,000
- Department of Indian Energy - Phase 1, 80% Design $210,000
- Department of indian Energy - Construction funds $990,000
- Alaska Energy Authority - Construction funds $2,300,000
- Gwichyaa Zhee Corporation - Company Start-Up Funds $300,000
- Denali Commission & Alaska Energy Authority - Diesel Power House Design & CHP BOP $280,000
- Alaska Energy Authority - Diesel Powerhouse Construction $3,500,000
- Gwichyaa Zhee Corporation - Diesel Powerhouse Construction $400,000
- Total Funding Secured:  $9,317,105
- Wood Energy Workshop, 10.14-19.2012






## 2013 ASSESSMENTS & PERMITS COMPLETED

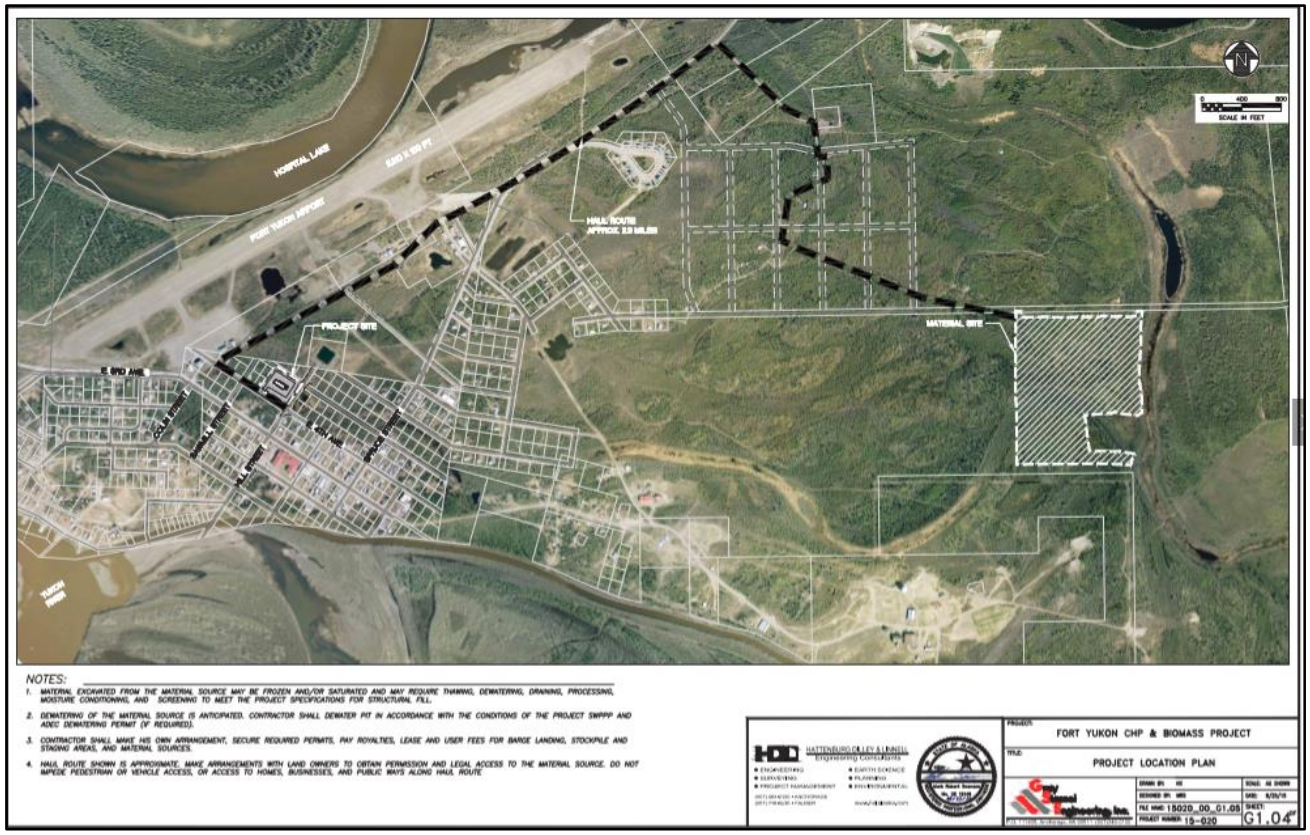
- CATG/GZ Corporation Biomass Harvest Agreement 2.28.2013
- NEPA Environmental Assessment (FONSI) completed 5.6.2013
- Revised heat utility model submitted and passed 7.26.2013
- Eagle Nest Survey completed 8.17.2013
- State of Alaska issued Alaska Forest Practices Act permitting 9.13.2013
- CATG Natural Resources Director Training: Forestry Technician Training: Basic Forest Skills 9.23-27.2013
- State of Alaska issued permit to cross Yllota Slough 10.9.2013


## 2014 NETWORKING

- Presentation to Council of Athabascan Tribal Governments and Gwichyaa Zhee
- Equipment Assessment Needs, Task strategy for each piece of equipment; Procurement List developed -
- Department of Tribal Energy Review: Golden, CA 3.14.2014
- Alaska Wood Energy Conference: Fairbanks, AK 4.15.2014
- Chipper Training & Demonstration:  Best Operational Safety Practices; Equipment Assessment; Biomass Moisture Measurement Requirement; Wood Chip Moisture Content; Hooking up/Loading & Unloading Chip Trailer & Bins 7.15-18.2014
- Harvest Equipment Operator & Safety Training (Kubota) - 11.4-6.2014
- Operator Training, Biomass Harvesting Mechanisms & Processing - 11.6.2014
- Training of Rural Forest Technicians Begins 12/1/2014

## 2015 DESIGNS & SETTLEMENT OF PAD

- Invitation to Bid for CHP Building package - January 2015
- 35% Design & Construction Estimate completed 3.25.2015
- Established force account payroll & reporting procedures completed 6.4.2015
- Site Development final design completed 8.25.2015
- Pad left to settle over winter months Fall 2015 & the Non-structural pad will be completed during the Spring of 2016
- Storm Water Pollution Prevention Program (SWPPP) stabilization measures were implemented to shut down construction until Spring 2016
- Training of Rural Forest Technicians Ends 12.1.2015



## 2016 CONSTRUCTION

- State of Alaska
- Final stamped Design Drawings for CHP Building package completed 1.20.2016
- Invitation to Bid for Biomass Boilers and Arctic Piping - February 2016
- 32% of Site Development Invoiced - 2.24.2016
- Completed CHP Building Pad - 6.6.2016
- CHP Building Mobilization and Completion of Concrete Footings and Slabs - June 6, 2016
- Final Stamped District Heat System Design drawing complete 6.8.2016
- CHP Building Steel Erection - 7.22.2016
- Final Stamped Biomass M&E Design drawings completed 7.28.2016
- Long Lead Items Procurement for CHP and district heat completed 7.31.2016
- CHP Building Exterior Complete - 8.5.2016
- Procurement of PEX Arctic Piping Materials, Steel Arctic Pipining, & other miscellaneous procurement
- District Heat Final Design Drawings Issued - 7.29.2016
- Heat Sales Agreement signed by the State of Alaska, Yukon Flats School District & KZPA Radio
- District Heat End-User Building mechanical work complete
- Installation of District Heat Arctic Piping began - 8.1.2016
- Construction CHP Building completed 9.26.2016
- Trenching, install district heat equipment in end-user buildings completed 10.31.2016
- Department of Tribal Energy Program Review:  Denver, CO 11.14-17.2016

COUNCIL OF ATHABASCAN TRIBAL GOVERNMENT

GWITCHYAA ZHEE UTILITY CO.

FORT YUKON WOOD ENERGY

PROGRAM-WOOD BOILER DEPLOYMENT AK

**2016 DOE PROGRESS REVIEW TRIBAL RENEWABLE ENERGY**

PRESENTERS: JAMES KELLY, CATG FRANNIE HUGHES, GWITCHYAA ZHEE CORPORATION/ UTILITY CO.

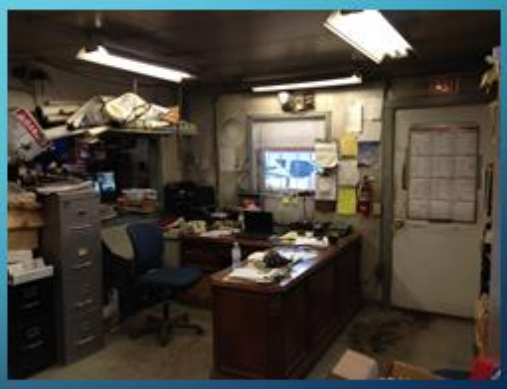
## FORT YUKON WOOD ENERGY PROGRAM WOOD BOILER DEPLOYMENT

- SOW: construct a wood boiler and district heating system in Fort Yukon, AK
- Our DOE grant was initiated in 2008, to harvest willows for stand-alone boilers
- The concept to combine local resources together, our village elected to work on replacing our existing diesel generator power plant with a combined heat & power project.
- This DOE grant: Wood Boiler Deployment evolved into our CHP, the Wood Chip Boiler will heat a District Heat Loop combined with Waste Heat.

PROJECT LOCATION: FORT YUKON, ALASKA

**FORT YUKON WOOD ENERGY PROGRAM**

EXISTING POWER PLANT



The Yukon Flats, the interior of Alaska , Fort Yukon , is located on the Yukon River. We are just below the upper mouth of the Porcupine River.

## SPRING 2015- CHP CONSTRUCITON START DATE

- Our project first construction set back; Porcupine River Flood- the May flood filled our only gravel quarry.

This was a crucial set back for our project as we planned the CHP Pad construction as soon as the Yukon River was navigable. Due to the large volume of water and high water table, a new gravel pit was needed; with the support of Doyon and GZU & Tribal staff, potential gravel sites were explored in the remaining May & June.

- OPTIONS FOR DEWATERING THE PIT WERE EVALUATED. A SURVEY OF THE WATER DEPTHS OF THE FLOODED PIT WAS PERFORMED BY MANLEY LAND SURVEYORS IN JULY, WHO WERE ON SITE COMPLETING THE CHP REPLAT. THE SURVEY DISCLOSED THE VOLUME OF WATER IN THE PIT EXCEEDED 40-MILLION GALLONS, AND THE WATER TABLE AT THE PIT WAS 2-FEET BELOW THE SURFACE OF THE FLOODED PIT.
- BASED ON THIS INFORMATION A PREFERRED GRAVEL SITE WAS SELECTED ADJACENT AND WEST OF THE EXISTING FLOODED PIT. A GEOTECHNICAL INVESTIGATION WAS CONDUCTED BY GOLDER AND ASSOCIATES TO ASSESS THE QUANTITY AND QUALITY OF GRAVEL AT THE SITE. THE INVESTIGATION FOUND GOOD GRAVEL AND VERIFIED THE SITE WAS NOT AFFECTED BY THE FLOODWATERS AT THE ADJACENT GRAVEL PIT.
- WE WERE FINALLY ABLE TO HAUL GRAVEL IN AUGUST 2015, COMPLETE THE PHASE I OF THE CHP PAD, **MID OCTOBER 2015**.

August 2015

## Construction Phase 1: Gravel Pad

**Clearing Gravel Site, Grubbing**

## Clearing-Developing New Gravel Source

## More site clearing

## Pushing up over burden

Gravel Hauling starts…

New CHP site


STOP

End of CHP Pad Phase 1 October 2015

June 2016, as pad sat over the winter to settle, now to begin work to complete the pad construction.


**Construction Phase 2: Northern Management Services, contractors, begin foundation work June 2016 as our crew worked on the district heating system.**

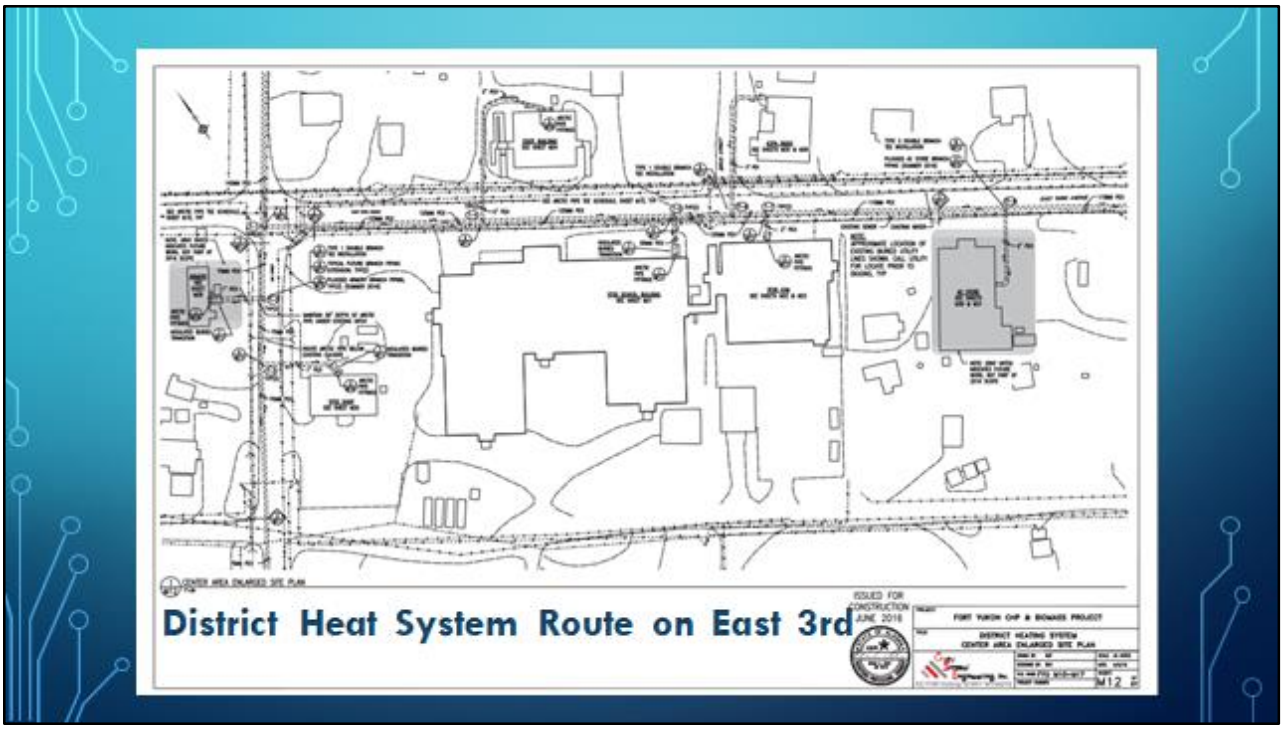
Notice, with climate change , we now understand the need to insulate foundation work, this keeps the permafrost intact.

# FOUNDATION WORK COMPLETED, NOW THE BUILDING CONSTRUCTION BEGINS:

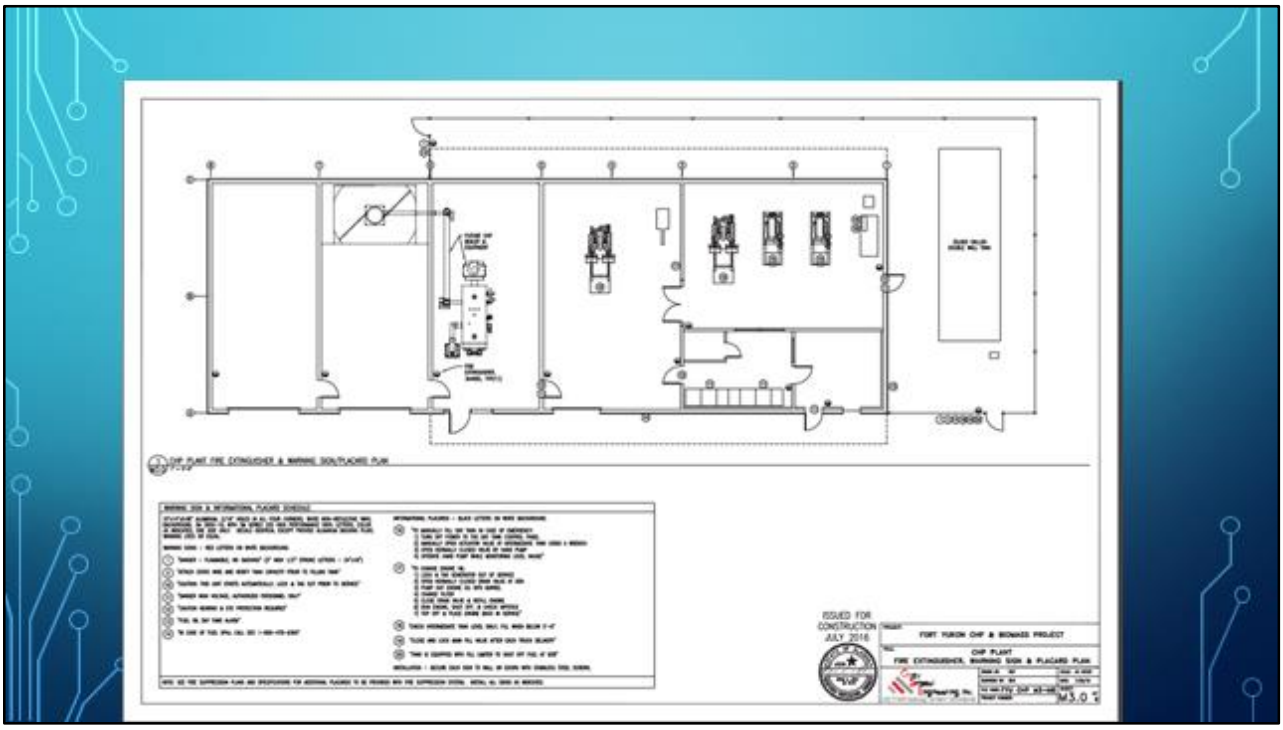
## Building Construction finished September 2016

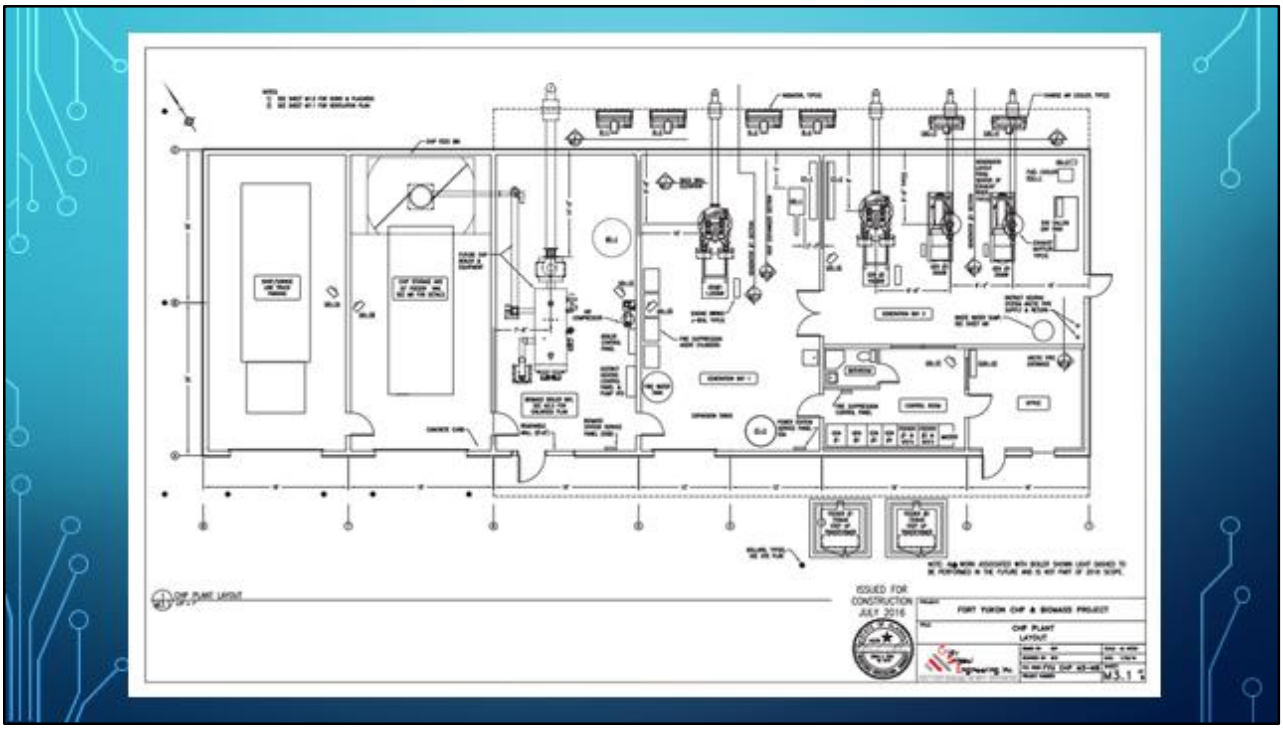
Current SOW:
- electrical
- welding & fabrication

## CHP DESIGN DRAWINGS:



District Heat System Route on East 3rd




ISSUED FOR CONSTRUCTION
JULY 2016
FORT YUKON CHP & BIOMASS PROJECT
CHP PLANT LAYOUT
M3.1


KÖB
PYROT

## **Kob Pyrot Boiler:** *Benefits at a Glance*

- High efficiency with advanced combustion technology, triple-pass heat exchanger and modulating output control (turndown ratio 4:1).
- Maximum heat transfer with triple-pass heat exchanger design.
- High efficiency and ultra-low emissions with precisely controlled primary and secondary air.
- Automatic ignition device limits idling and saves fuel.
- Low maintenance with fully-automatic deashing, optional pneumatic cleaning system and flue gas deduster.
- Advanced safety equipment ensures safe and reliable operation.
- Custom design of your system by our team of experts.

## CHP- COMBINED HEAT POWERHOUSE

<u>District Heat Loop captures:</u>

-Waste Heat from diesel generators

-Biomass boiler

## CHP/ BIOMASS PROGRAM BENEFITS

- Energy Cost Reduction-Displace Fossil Fuel
- Improve Environmental & Health Issues
- Habitat Enhancement
- Wildfire Mitigation
- Improves Local Economy

## TO MOVE FORWARD CHP/BIOMASS PROGRAM

- Update sustainable 5-year harvest plan & support structure
- Wood harvest, transportation and delivery planning
- District heat system design includes wood delivery and storage system functions
- Harvesting permitting processes- Global warming is a concern-winter harvest
- Boiler operations functioning
- Training & capacity building functioning
- Feed the boiler

## BOILER SYSTEM

- Chip Fired 1600-2000 tons per year @ $175/ton
- Displace 67,000 Gallons per year @ 7 buildings
- 14 year payback @ $4/gallon
- 6.5 year payback @ $6/gallon

## ACREAGE HARVESTED FOR HEATING

- 2,000 tons / year heat
- 25 tons/acre
- 40 year rotation
- 80 acres / year
- 3200 acres / rotation
- Historical wildfire events have burned 80,000 acres in one month
- Global warming-changes 2016

  no wild fires, as a rainy season

AS BUILDING CONSTRUCTION CONTINUES, THE DISTRICT HEAT LOOP INSTALLATIONS:

STARTED LAYING PIPE FOR THE HEAT LOOP AT CITY WATERHOUSE - NOTE THE HEAT EXCHANGE PIPE. W/ GLOBAL WARMING CONCERNS WE INSTALLED THE HEAT LOOP ABOVE THE EXISTING INFRASTRUCTURE.

# THE TRENCH ROUTE ON E. 3RD AVE FOR DISTRICT HEAT LOOP

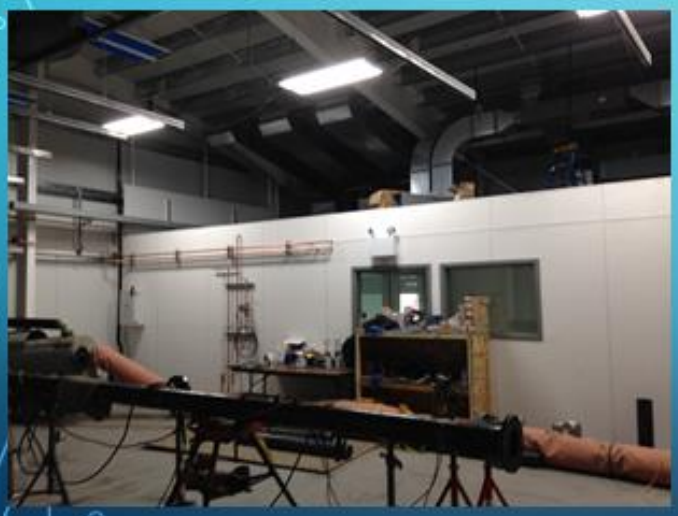
## WORK AT THE STATE BUILDING

## YUKON FLATS SCHOOL DISTRICT MAINTENANCE BUILDING

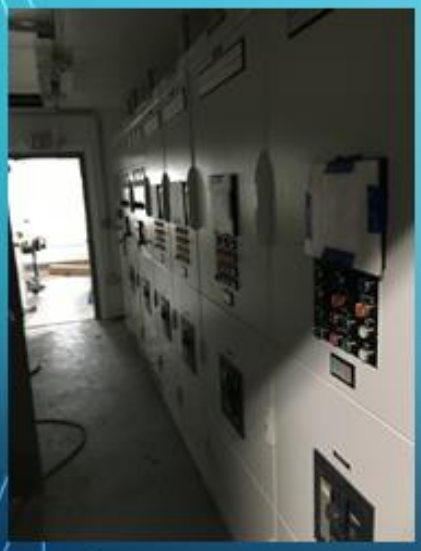
## FINAL HEAT LOOP ROUTE TO THE NEW CHP BUILDING

## OCTOBER 2016 CHP INTERIOR INSTALLATIONS

## CHP OFFICE & CONTROL PANEL ROOM



## Control Panel Room & Generator Room



## CHP WILL BE ONLINE FEBRUARY 2017

WASTE HEAT WILL BE CIRCULATING THROUGH THE DISTRICT HEAT SYSTEM AT 25% FUEL SAVINGS UNTIL SEPTEMBER 2017, WHEN THE BIOMASS BOILER IS ON LINE.

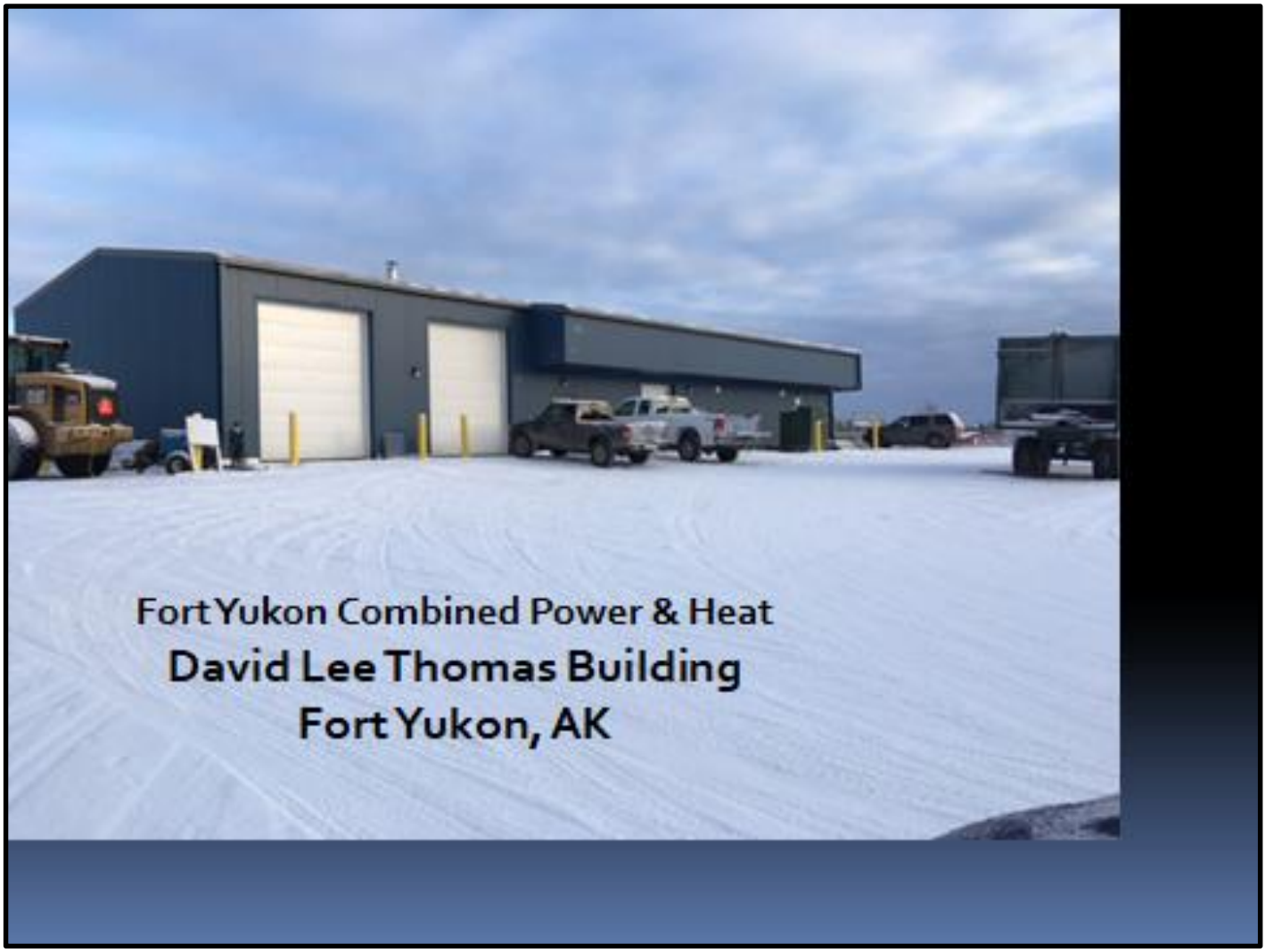
# ACKNOWLEDGEMENTS


- Council of Athabascan Government (CATG)
- Department of Energy, Office of Indian Energy (DOE)
- Gwitchyaa Zhee Corporation (GZC)
- AEA
- USDA RUS
- Denali Commission
- Gwichyaa Zhee Gwich'in Tribal Government(GZGTG)

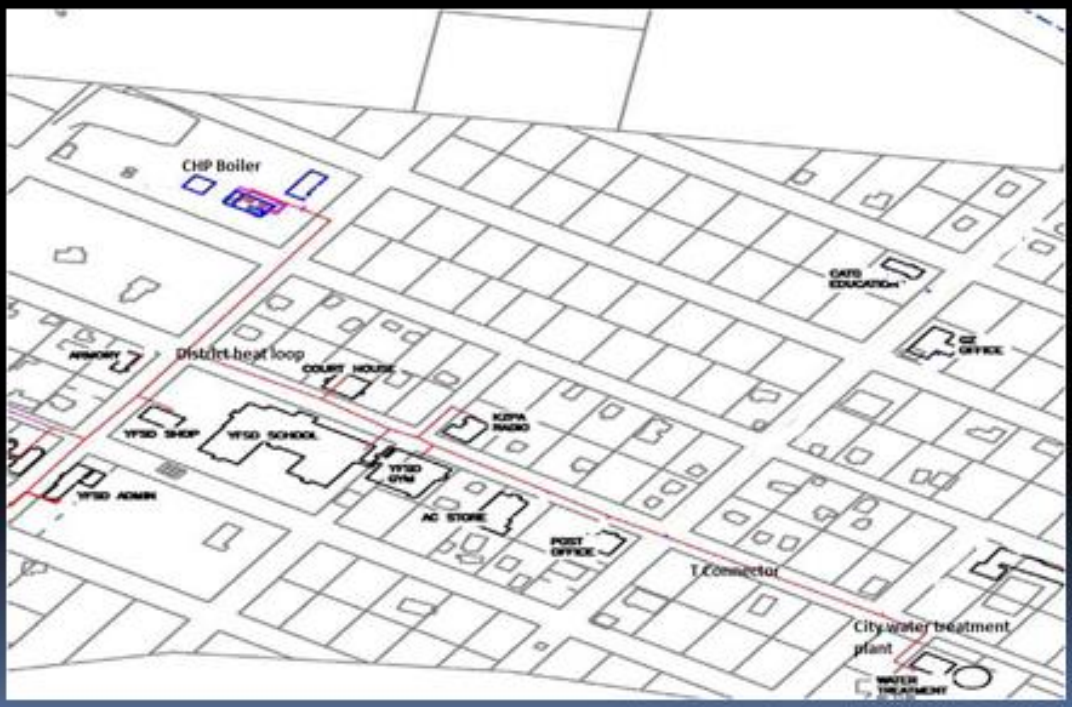

*Previous CATG Natural Resources Director James Kelly Sr & GZ Corporation CEO Frannie Hughes presenting at the 2016 Tribal Energy Conference, Denver, CO.*

## 2017 CONSTRUCTION/TESTS/OPEN HOUSE

- Commission district heat system completed 1.7.2017
- Additional district heating glycol procurement completed 8.2.2017
- Biomass boiler arrived on site 10.3.2017
- Biomass push floor trailer arrived on site 10.6.2017
- Department of Tribal Energy Program Review: Denver, CO 11/13-16.2017
- GSE progress inspection & troubleshoot problematic Series 60 idle issues 11.16-17.2017
- CHP Ribbon Cutting to the David Lee Thomas Powerhouse 11.17.2017
- Gutter prefabrication, CHP Electrician completed electrical work with materials on site 12.4.2017



# Fort Yukon District Heating System




Installing District Heat Loop with Arctic Pipes, this was installed over the ANTHC's water-sewer infrastructure.

# Kob Pyrotec Boiler

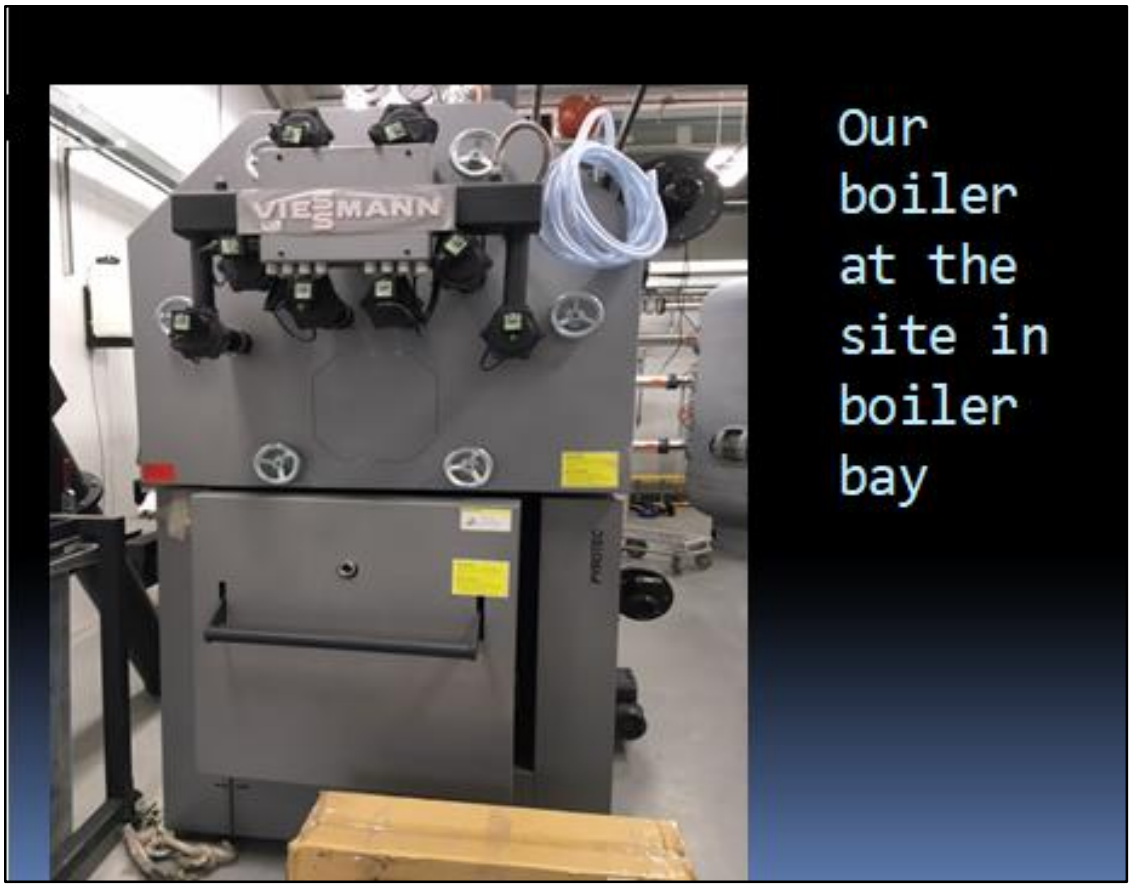
**Our Biomass Chip Boiler!!!**

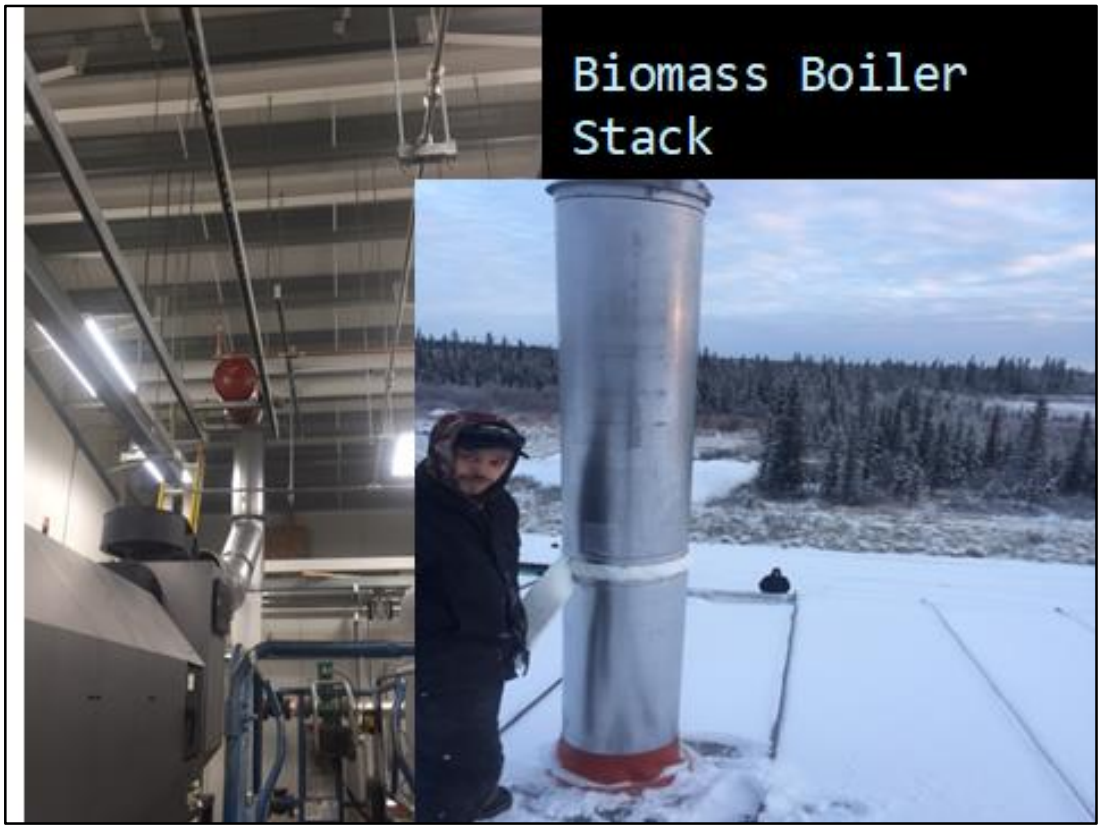

- Feed auger (with light barrier)
- Burner trough with internal grate
- External grate
- Moving annealing grate
- Secondary air flow
- Ignition fan
- Deashing system
- High-temperature burnout zone
- Combustion chamber door
- Triple-pass heat exchanger
- Safety heat exchanger
- Pneumatic pipe cleaning system

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.

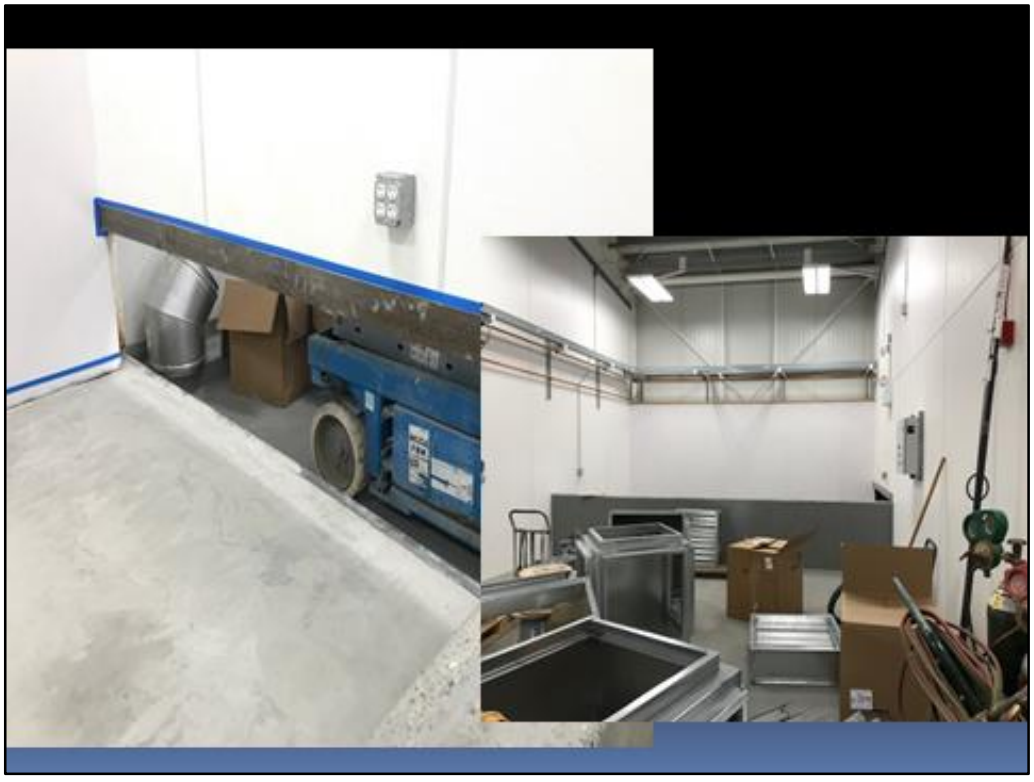

BOILER IN
CONNEX
NEW PLANT

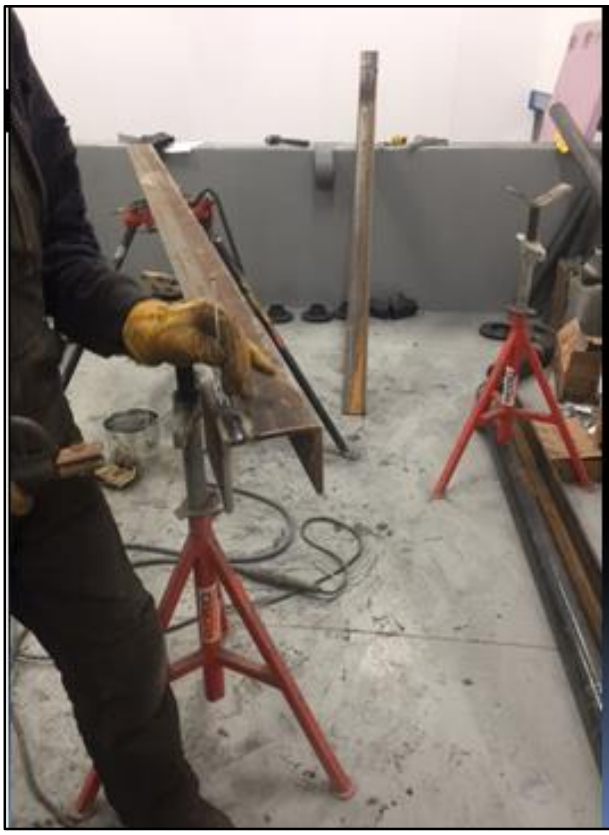

Boiler inside the bay


VIESMANN
Our boiler at the site in boiler bay


Biomass Boiler Stack


Our above the Arctic Circle Style Chipper Bin beginning construction

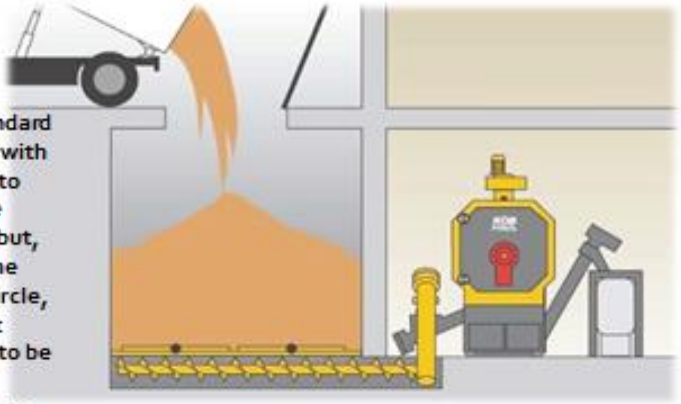




Continued construction work for the chipper bay

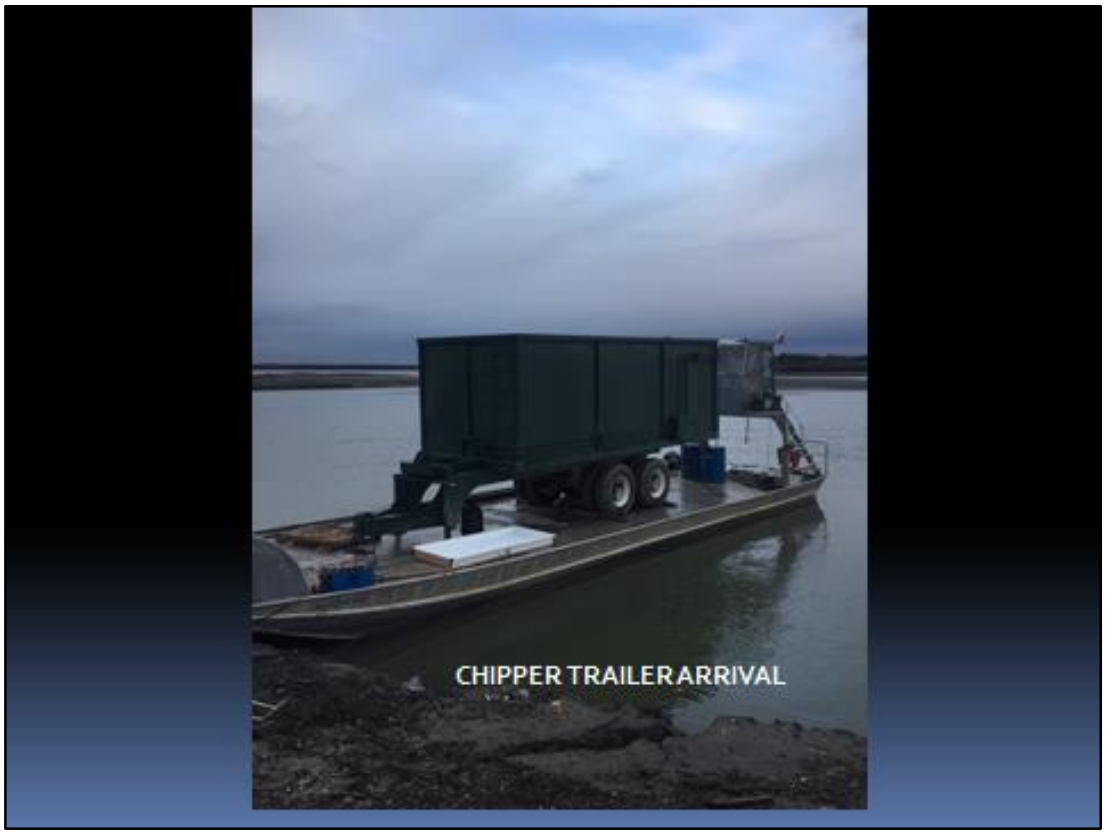
# Fuel Conveyance Systems

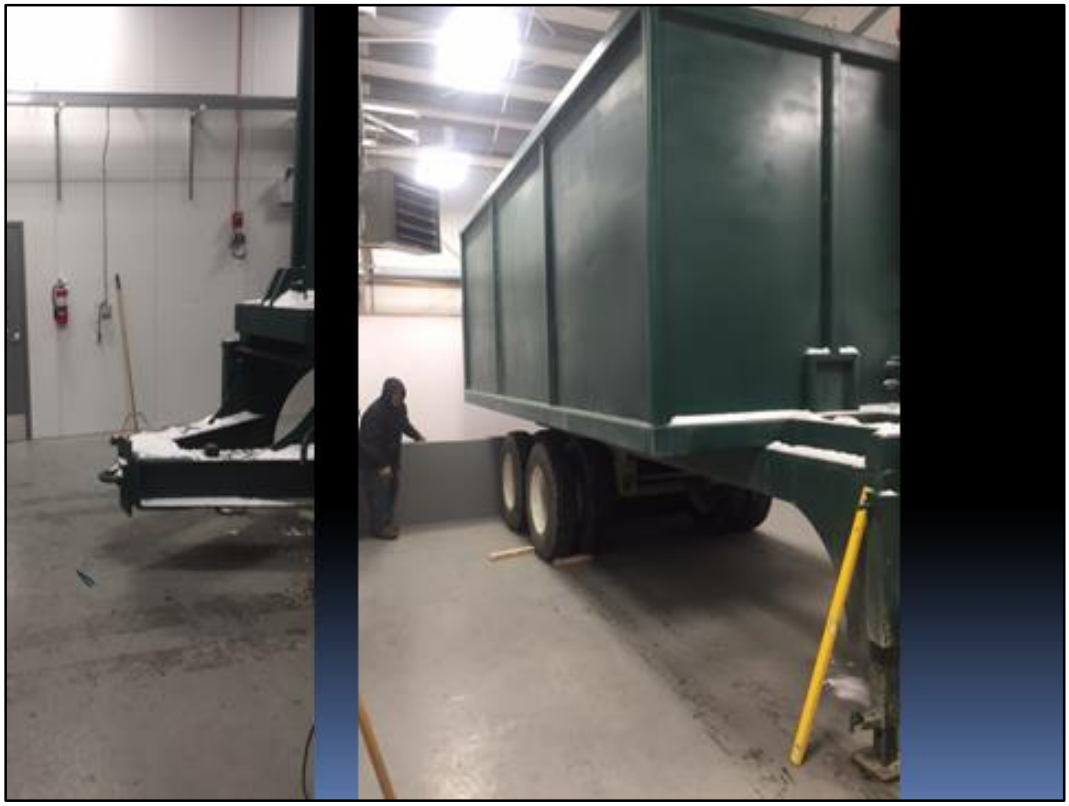
The standard chip bin with hopper to feed the boiler…but, above the Arctic Circle, we must modify to be in compliance



a3 energypartners

www.a3energypartners.com


CHIPPER TRAILER ARRIVAL



MOVING FLOOR & HYDROLIC S
Chipper Trailer

# Organizational Overview:

- **Council of Athabascan Tribal Governments (CATG)**
- Consortia of 10 Tribal Governments of Interior Alaska
- **Gwitchyaa Zhee Corporation (GZ Corp)**
- Alaska Native Claims Settlement Act Village Corporation

# Harvest Equipment Operator and Safety Training

Held Classroom instruction & Field time instruction

*Selections based on:*
Previous experience
Attentiveness
Safety Awareness
Work Ethic
Comradely
Common Sense

*Overall Objectives:*
Operational Safety
Operational efficiency
Regulatory compliance

WOOD BOILER PREPARATIONS:
SITE PREPARATIONS

- ADDED GRAVEL TO CHIP SITE

HAUL OUR HARVEST FROM HARVEST SITE TO CHIP STAGING SITE

THE HEAT LOOP HAS A READING OF 180 GOING OUT OF THE CHP AND A RETURN OF 165.

WHEN TEMPS DROP TO MINUS 20, WE WILL NEED THE BIOMASS BOILER 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


# 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

# Fort Yukon Wood Energy Program

## Lessons Learned

Be Vigilant

Monitor the overall project Budget

Be willing to stop project to Get the updates & answers

You will need to Make good decisions

Always & Always check the Weather!

## Activities Yet to be Completed

Electrical work on Biomass Boiler

Run through of all Harvest Equipment, Trial Chipping

Hauling the Harvest wood to Chipper Staging Site

Commission Biomass Boiler

Heat Sales Agreement W City

Update Heat Utility Business Plan.

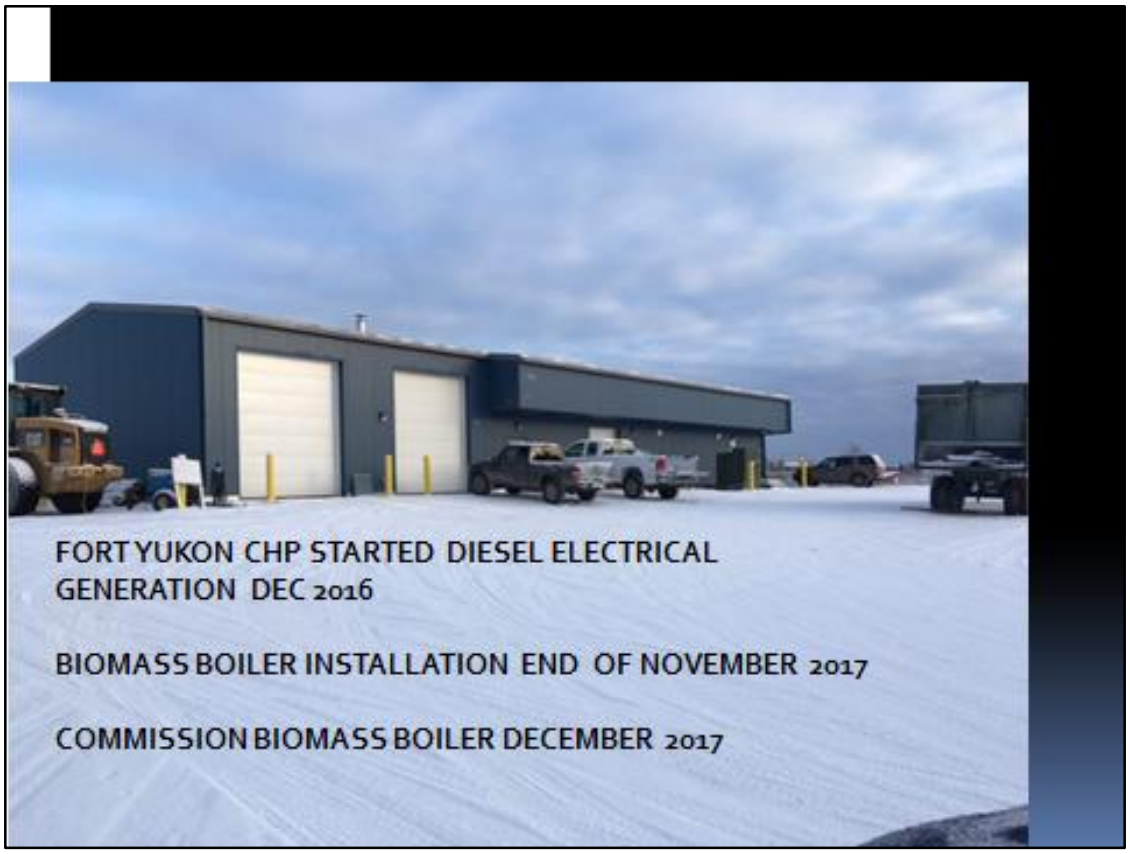
- Only accessible by boat during the summer, snow machine during winter, plane, and Yukon Barge.

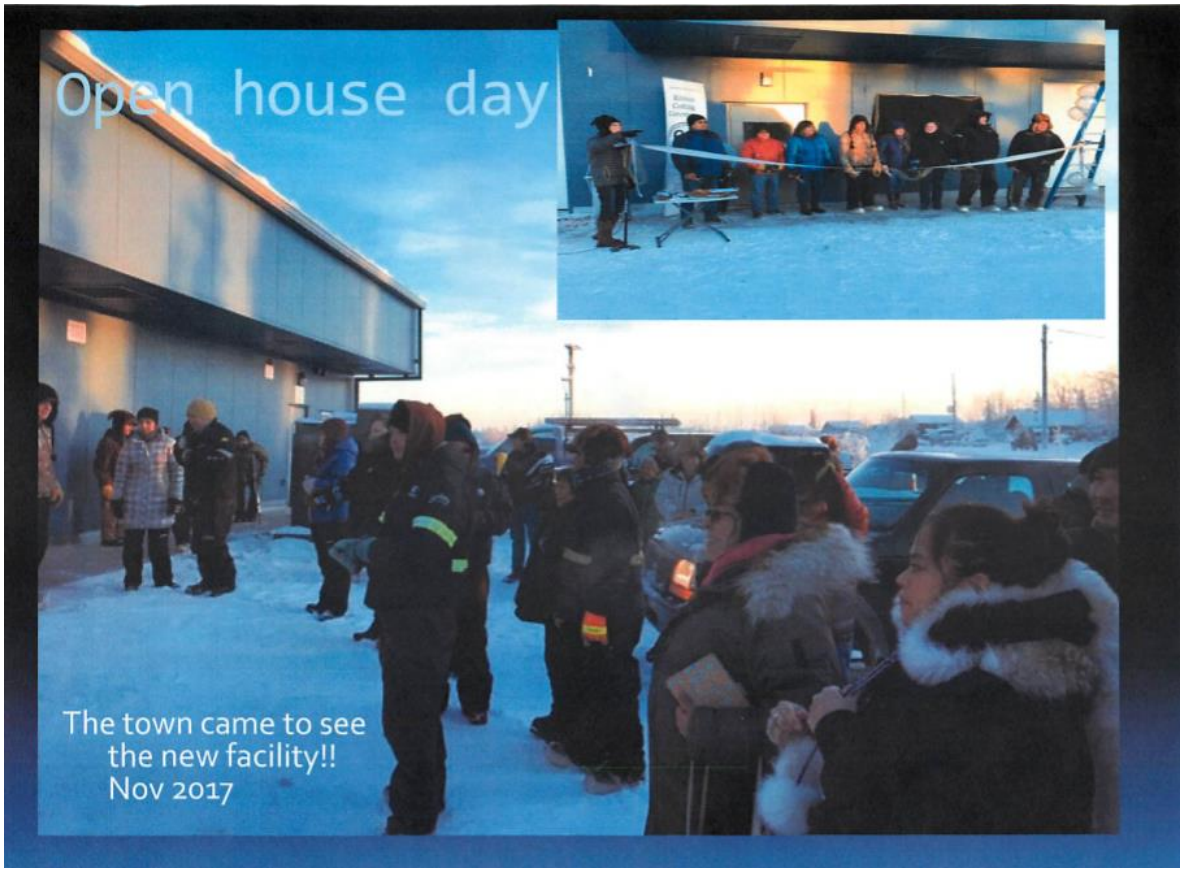
## For-Profit Wood Energy Business Model Fort Yukon

- 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

## *Future Plans*

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 CHP STARTED DIESEL ELECTRICAL GENERATION DEC 2016
BIOMASS BOILER INSTALLATION END OF NOVEMBER 2017
COMMISSION BIOMASS BOILER DECEMBER 2017


Open house day
The town came to see the new facility!! Nov 2017

## 2018 REPAIRS/TESTING/FINAL PRESENTATION & FINAL REPORT

- Current River Electric, Biomass equipment repair 1.16-29.2018
- Install Biomass VFD Display, Boiler testing and Boiler SCADA communications verified 6.8-10.2018
- Final Presentation by Gwichyaa Zhee, CEO Frannie Hughes 12.14.2018
- Submitted Final Progress Report to the Department of Tribal Energy 12.29.2018

## 2019 TECHNICAL REPORT SUBMITTED

- Submitted Final Technical Report to Department of Tribal Energy, by Bruce Thomas, CATG Natural Resources Director 3.30.2019


*Old Site*

*New Site*

## Fort Yukon Wood Energy Program: Wood Boiler Deployment

## RECOMMENDATIONS

### 1. MEMBER TRIBES OF CATG DID NOT BENEFIT

- The Council of Athabascan Tribal Governments is a consortium of ten tribes one of which is the Gwichyaa Zhee Gwich'in Tribal Government (GZGTG). The third constitutional intent of CATG is to aid and support economic development for member tribes. We are pleased and appreciate the opportunity that the community of Fort Yukon benefitted from the Fort Yukon Wood Energy Program: Wood Boiler Deployment initiative. However, we make plain our disappointment that the GZGTG was not tied into the waste heat loop.
- Although CATG served as a pass-through entity, we were ultimately responsible for the grant and thus responsible for the Quarterly, Annual, Final and Technical reports. Further, CATG also had to: 1) Carry adequate insurance to indemnify the GZC from liability due to an accident or negligence; and, 2) Be responsible for the filing and maintaining records of permit applications.
- The Gwichyaa Zhee Corporation is exploring options of tying in other entities to the waste heat loop. It is our recommendation that the GZGTG be inclusive of this endeavor.

### 2. CONTRACTS THAT ARE ENFORCEABLE

- The grant is over; but, not the problems. Hindsight tells us that in order to avoid disputes and misinformation, pre-signed legal and binding contracts by all stakeholders should have been executed prior to construction. One contract was not signed. This is by the Co-Partner at the end of the loop. Now, we cannot simply shut this Co-Partner off because there are no shut off valves into any of the Co-Partner buildings. This Co-Partner did not sign a contract but was part of the project.

- It is the recommendation of this grantee that prior to construction, in order to facilitate and foster continuity all co-partners must perform the following: 1) Contracts are read and understood before signatory authority issued; 2) Contracts are confirmed in writing and by receipt; 3) Co-partners know their legal obligations; 4) Leads develop good and continuous communications and relationships; 5) and, Leads be organized in training of new incoming administration in respective Co-Partner entities.
- This grantee believes that all Co-Partners must have a continuing obligation to the project and the subsequent maintenance of the project. This must be cemented, prior to project implementation, by a legal and binding contract.

## 2. ENSURE DEED SITE CONTROL

- One recipient of the loop rents from another entity that is also included in the loop. So, Recipient A looks for guidance from Recipient B since Recipient A rents from Recipient B. When it came time to provide data, Recipient A was reluctant to provide fuel consumption data since the installation of the loop because Recipient B made their position known and voiced their opposition to proving the requested data. Recipient A is fearful of retaliation from Recipient B and have no other venue to conduct business should Recipient B evict them. It is the recommendation of this grantee that all Co-Partners have deeds to their own land and buildings before they are included in the grants. This is to avoid strife, contentions, and gang-ups down the road and all recipients' autonomy would not be dictated by the views and opinions of another.
- The very first hurdle was to work with the local tribal entity to gain access to a parcel of land to build the new generator. We were overly long in this fray to gain site control where the new generator now sits. It is the recommendation of this grantee that deed issues be resolved prior to grant implementation.

## 3. IDENTIFY LOCATOR PROBLEMS

- It is the recommendation of this grantee that prior to implementation of the project, that Locator lines be ascertained such as phone, water, and gas lines. This entails cooperation from the phone company and the city in which the project is being implemented. A private company had to be brought in to locate the water lines at an additional cost of $6,000. A Co-Partner demonstrated resistance and zero cooperation with providing location of the lines. Cooperation of Co-Partners must be included in the contract no matter the turn over in administration.

## 4. TURN OVER IN ADMINISTRATION OF CO-PARTNERS

- There has been mass turnover since the inception of the Department of Indian Energy Biomass grant with CATG. 85% of the original co-partner administrators including those within CATG are no longer in office. However, Gwichyaa Zhee, the main stakeholder, remains cognizant of the original intent of the grant throughout all of the stages: concept, proposal, award, implementation to closeout. CATG and GZ recognizes that there was a need for continued education involving the four beneficiaries of the loop to remain abreast of changes, original contract obligations, and the progress of this endeavor.
- It is the recommendation of CATG that an ongoing list of Co-Partners be maintained for continuity purposes, and as the need arises, the successor(s) be apprised of the grant and grant intentions in a short fact sheet. A current problem is tensions are high because of this turnover. It is the intent of CATG to hold a Co-Partners luncheon with all the stakeholders for educational purposes:
- To apprise all of the original intent, goals and objectives, and benefits of the grant. And now that the grant is over – how to maintain the system and the responsibilities
- To make plain our responsibilities as the Pass-Through grantee.

- To enlighten Co-Partners of their responsibilities and explain the contracts they signed
    - There is an ongoing list of Administrators from each entity/council
    - As each position receives a new person, this needs to be appraised in the Contract/grant.

## 5. MORE EDUCATION OF BENEFITS IN COMMUNITY

- There were breakdown in communications, change in administration, technical problems, rumors of differing views and underlying facts. With present problems with new Administration within the Co-Partners.
- How do we fix this? All co-partners need to be brought back to the table to discuss how the Biomass Projects benefits the whole community. The Yukon Flats School District benefits because 48% of their previous funding was exhausted by fuel consumption. Now, funds are freed up for student instruction. The State of Alaska, the most efficiently maintained, benefits by freeing up funds for law enforcement. The KZPA Radio station benefits by being unfettered by the high cost of fuel and continue to be the "voice" of the region. The City of Fort Yukon benefits because, they too, are disenthralled by huge fuel consumption and can now concentrate on quality water service and expanding service delivery to the new subdivisions.
- It is our recommendation that future grantees would have more meetings with the Co-Partners and community education in support of long term sustainability of the Biomass at each progressive step during project development.

## 6. INFRASTRUCTURES IN PLACE

- There were too many re-designs of the building and loop installation resultant in unexpected cost and rebudgeting . It is the recommendation of this grantee that there are pre-planning steps that other grantees follow prior to inception. The five biggest factors working against us were: lack business and forestry plans, time, isolation, cold weather and not planning adequately for these factors.

1. We did not have a Business or Forestry Plans in place prior to inception. A Business Plan would have given us a roadmap to follow that shines a light on the cohesive vision and endeavor. Also, a Forestry Plan was needed at the beginning to determine: where wood was to be harvested, when, by whom and where to store it in the interim before it is actually furnace ready.
2. From start to finish was ten years. Because of this project estimates had changed, some vendors that we were dependent on were no longer in business which caused us to desperately seek out new vendors when the time was right. Inflation had changed the cost not only in merchandise pricing but the shipping thereof, and there were cold weather delays.
3. The location in which the project was done is extremely isolated. Weather and or other factors can hinder transportation of the materials, gear and machinery. If weather prevented the last barge from coming, that would throw off the execution of the next phase that was dependent on said materials. Fort Yukon is not on the road system and project's overrun and budget rewrites was often. It is our recommendation for a more accurate analysis of cost expenditures and contingency plans should barge schedules change.
4. Machinery is hard to operate or breaks down during extreme cold. Fort Yukon is in a valley between two mountain ranges. The law of the cold seeks out the lowest elevations. Future grantees should factor in extreme weather and determine whether or not that this could hinder their project.
5. The project demanded static expenditure projections. Time and again, the timeline changed because of the isolation and weather. This caused delays, substitutions, rewrites, and replanning. A grantee needs to take into consideration and make contingency plans caused by isolation and weather.

- The Chipper Bay space has insufficient space to dry the wood chips. A Chipper Bay should have been in another building not only for drying purposes but also for safety reason. We needed more wall protection in the Chipper Bay than the

design called for. But, this entailed a re-negotiation. Another reason why a separate building is needed is because the type of spruce that grows in this area possess more moisture than spruce to the south of the White Mountains. Consequently, this requires a longer drying time which demands more space for the "various levels of dryness" piles.

- Plexiglas needs installing over the converter. When the operator needs to see the conveyor, he has to lift up the converter window. When the converter window is lifted up, the conveyor stops. It would behoove the next grantee to install Plexiglas over the converter.

## 7. ENERGY AUDITS NEEDS TO BE DONE PRIOR TO INSTALLATION

- The purpose of an energy audit is to analyze energy flows within a building. Energy loss could be due to insufficient insulation, windows, doors, age and type of furnace. Only by happenstance did we learn of the energy ineffectiveness of some of the buildings. This led to energy loss and re-analyzation by the engineer as to why some buildings were more efficient than others. This was an added cost. Some of the Co-Partners had to be informed on heat loss caused by opened windows, poorly monitored thermostat control settings, and poor insulations. This was after the loop was installed and the loop turned on.
- These energy audits needs to be included in each contract. And, that the Co-Partners agree to stipulations and maintenance prerequisites regarding heat conservation by regulating their respective thermometers and refrain from opening windows and doors in the winter months. The waste heat loop is a continuous loop. Once it circulates one building, it continues on to the next building. If heat is lost in one building, the next building will not receive the same amount of service as the previous building. In short, this actually robs the next recipient in the loop of the same quality of service.
- It is this grantees recommendation that each Co-Partner utilize an energy use kit or an energy audit prior to installation in each building that will be receiving

waste heat. Only after an energy audit is conducted that Co-Partners could be included in the grant.

## 8. INSTALLING SHUT OFF VALVES

- Waste heat loop should have individual shut off valves. Upon being hooked up to the loop, it was found that some entities were uncooperative in providing fuel-use data for our reporting and refuses to pay a maintenance fee. We are unable to shut off their services from the heat loop, as the design format was a universal-circulatory loop.
- It is our recommendation that all future grantees should have shut off valves for this purpose.
- Ultimately, everyone benefits from this project - the whole community. Should the economy collapse, then power can continue to be provided via the wood boiler system. However, there is such strong resistance from one of the Co-Partners that is erroneously under the impression that since the waste heat loop was installed by a grant therefore it is free. Yes, the loop was installed by a grant, however the maintenance is not free and comes at a cost. Again, our recommendation is to have contracts in place prior to construction.

## 9. BLUEPRINTS NEED TO BE IN 3-DIMENSIONAL FORMAT

- There are many facets and steps in any construction project. Some still utilize the traditional 2-dimensional method as did we. This had led to some costly problems in which walls had to be torn down and rebuilt using sound-proofing materials. A 3-dimensional blueprint would have served the project better as grantee could have been cognizant of the type of construction for a sound-proofing wall and ceiling for the office as a sound barrier against the generators.
- Also, in the new power plant there is no wall space much less space to lay out the 2-dimensional blueprints. There were times when all the construction staff, at safety meetings, needed to see the blueprints and to be cautioned where hazardous construction was taking place in order to avoid thee area(s).

However, there was no space to crowd around a 2-dimensional blueprint. It would have served the project well to have a pull-down projector screen to project the 3-dimensional blueprint for fast and efficient viewing.

- This project entailed using three different electrical vendors. Grantee was not informed where the installations were taking place and there were times after the vendor left, that staff had to make an educated guess where the outlets were. It is the recommendations of this grantee that staff meet with all in-coming vendors to discuss the phase and purposes of their contributions using the 3-dimensional blueprints. Should we have had these blueprints in 3-dimensional format, then the three vendors' work could have been dovetailed seamlessly.

## 10. NEED MANUALS PRIOR TO FINAL REPORT

- Because we are only the 2nd entity to have established a wood boiler in the Interior, we have to build our own user manual, and independently navigate any problems that arise during operation of the wood boiler.

## 11. MORE PERSONNEL

- This is a big operation that requires four cords of wood per day for 275 days a year. There were two things that were not expanded on: Sustainability after construction and space.
- In order to sustain a project of this magnitude, our two Generator Operators have enough to do without this added duty. At least 3 people for a crew to constantly operate the wood boiler: consisting of a Wood Boiler Manager, Yard Worker, and a Dryer/Feeder. The Wood Boiler Manager would have supervisory authority over the Yard Worker and the Dryer/Feeder.
- Project does not have the floor space for curing the chips via air drying and/or heat drying; thus have opted for the Self-Drying method outside of the building. This requires managing many piles and each with different levels of dryness.

- The Boiler deem that chips that are ___% cured can be used. We live in Alaska with a shorter drying season. Again, this requires chip pile maintenance.
- It is our recommendation that grantee should plan for drying space any using one of the three methods determined by their climate. Further, it is our recommendation that grantee plan for long-term sustainability and the employment of more personnel to manage the endeavor.

## 12. SECURITY NEEDED

- The compound needs fencing with surveillance. Currently, this is an unprotected area. Reality tells us there is an increase in theft, vandalism, arson, and crime in our area. The recovery of stolen items is miniscule. This is a multi-million dollar facility and should be protected from theft, vandalism, arson, and other crime.
- This project demands four cords of wood per day for approximately 275 days of the year. That is a lot of wood. Given that the wood will be coming in daily, it needs to be secured in a fenced in area. The fencing would also deter crime as it sends a message that theft, vandalism, arson, and other crimes committed against us will not be tolerated.

## 13. KNOW YOUR VENDORS

- Please know your vendors. It has been our experience that there are many vendors that are out there that do not share your same values. Some vendors just want to get the job done and get out as quickly as possible. Others would "milk" the job. GZ has the best Manager and she was able to discern the latter immediately. For the former, Quality Control was an issue of those vendors who are not local and have no vested interest in the project other than monetary gain.
- A grantee must check the reliability and reputation of their vendors. We recommend that vendors be checked with the Better Business Bureau.

# Fort Yukon Wood Energy Program: Wood Boiler Deployment

# Council of Athabascan Tribal Governments

# LESSONS LEARNED

## 1. MORE PLANNING WAS NEEDED

It would have behooved us to have had more strategic planning which is a process of organization that streamlines our vision, direction, goals, objectives and objectives, priorities and decisions aligning them to our resources to accomplish action items. The Strategy Plan it would have demanded us to write both a Business Plan and Forestry Plan to ensure a smoother operation. These plans were written eventually.

a. A Business Plan is a very important planning tool for any new business venture, who are serious about starting a business and details our purpose; essential to building human resources and operational requirements and needs. It would contain Action Plans for each objective detailing how it was to be accomplished by answering these universal questions prevalent in Action Plans: what was the plan, why and for what purpose, who & how many manpower hours are required, where was it to take place, when was it to take place, and how was it to be accomplished.

b. In the same token, A Forestry Plan would have helped immensely containing the same universal questions as above, but also inclusive of the permits needed, contingency plans should a natural disaster strike, stewardship of the land, where to cut, etc. In our case, a natural disaster did happen. The Yukon River Flood of 2013 destroyed our harvesting site. Again, the Porcupine River Flood of 2015 negatively impacted us. The site that GZ was planning to use for pad construction were not accessible which resulted in a delay. The pad was completed in Fall of 2015 and left to settle during the winter months.

The Lesson Learned is to have multiple sites of harvesting. We do now, but not at the time of the flood.

Photo above of Yukon River Flood, Fairbanks Daily News Miner 5.22.2013

## 2. CONTRACTS THAT ARE ENFORCEABLE

In the *Recommendations* portion of this report we have detailed this issue. In summary, legal and binding contracts are necessary to avoid disputes and resistance during any phase of the grant operations. For years, one Co-Partner vacillated between cooperating and opposition of which a contract was never legally ratified. This Co-Partner is at the end of the loop which makes turning off the loop an impossibility without negatively impacting the other Co-Partners. We will seek funding to install individual shut off valves.

## 3. BETTER COMMUNICATIONS WITH CO-PARTNERS

Many people are visual people, they like to see where they currently stand, percentage of project completed and what was accomplished. They also like to see what still needs to be done and how far they are from project completion. Building a status timeline is possible using Google suites that details each phase of the project. It is our Lesson Learned that more and consistent communications with Co-Partners is paramount. Also, to have communicated project status on a consistent basis using this type of timeline.

## 4. NEEDED MORE CONTINGENCY PLANS

The project duration was ten years. Many of those that were initially trained have moved on to other communities or professions. A whole new generation of workers need to be trained. First in Safety, Equipment, & how to harvest the timber resources. There were many factors that contributed to delays in the project that resulted in project extension: of which extreme climate and isolation were the biggest factors. One vendor dropped and broke a generator which caused a seven month delay because a replacement had to be ordered from Canada. A Lesson Learned is to plan, plan, plan.

# Fort Yukon Wood Energy Program: Wood Boiler Deployment

## BARRIERS AND OBSTACLES

## CLIMATE FACTORS/EXTREME COLD

- One has to be a tough and hardy breed to live and operate in the Arctic. The Yukon Flats of the Interior of Alaska is between two mountain ranges, where the cold settles in and around the Yukon River valley. Temperatures can reach an ambient temperature of -60 degrees below Fahrenheit or colder when there is a wind chill.
- Winter operations is hard on vehicles, equipment and machinery. The cold places extreme stress on these necessary items causing them to become brittle and thus easy to break. Equipment must be thawed and a marine blanket placed over equipment to retain the heat transmitted by a space heater. Even still, care must be taken in operations as hydraulics have a propensity to leak from plastic hoses. The harsh climate does damage to tangible machinery. We had to purchase a crimping machine to make "Artic hoses" that would withstand the cold.
- Since this is an isolated place, there are no auto-repair or equipment-repair businesses. Mechanics will need to be flown in to repair machinery at an added cost to the program should machinery breakdown.
- Reiterated from Recommendations. As stated above, the spruce and cottonwood that grows in the Yukon Flats has a heavier moisture content in the wood than spruce that grows south of the White Mountains. Wood is hygroscopic as it gains or loses moisture as the RH of the air surrounding it changes. As the humidity increases the moisture content increases causing the wood to expand. Too, we have such short growing seasons that moisture becomes trapped in the raw wood which requires a longer drying time.
- Too, many times the wind would contribute to a wind chill of -70 below degrees Fahrenheit. It is time-consuming to get any job done due to the cold climate.
- It is our recommendation that the cold factor be written or recognized in the grant of grantees. Harvesting of wood should be done in the spring and summer seasons. Most of the wood harvested is during the fall and winter seasons because it is easier to

transport over the snow. But, this would require a longer drying period. It would be more beneficial to harvest wood in spring and summer seasons in order for a shorter drying time.

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## ISOLATION

- This CHP Biomass Project is the first off grid road system CHP facility in the world. Fort Yukon, in the Interior of Alaska, is geographically isolated since our area is accessible only by air during the winter and by barge or air in the summer and parts of the fall. It is our recommendation that this factor is taken into context during the planning and development of a proposal, during budget development, and the execution of the grant thereof.
- This isolation will cause an increase in freight costs. Too, all your transportation options must be explored in case one mode becomes unavailable.
- Product availability is a factor. One cannot just run down to the local hardware company as there is none here. Some companies would ship and charge for the expedition fee. However, said freight would come in as space available or FIFO (First In First Out) policy. This must be taken into consideration.
- There is another hurdle that we had to overcome and that concerned the box-warranty of equipment that had to be modified for the harsh climate. For example, if the equipment had to be modified this resulted in modifying the manuals as well.

## TRYING TO DO TOO MUCH WITH TOO LITTLE

- This was a great project and the benefits are considerable. However, a Cost Study Analysis should be a methodology used for grant amounts. A small example of the high cost of merchandise in rural Alaska is: In Fairbanks, Alaska, an urban hub of Interior Alaska, a loaf of bread is $1.99 compared to Fort Yukon where that same loaf sells at $8.46 which is 425% higher than urban Alaska. In this context, the freight and expeditor cost should always be included at a higher amount the further the grantee is away from the source.

- The Washington D.C. climate is waning for Native American grants. Administrators and Tribal employees are forced to wear many hats with resources stretched so thin: trying to do too much with too little! This has always been the case in Indian Country.