



CHP  
TECHNICAL ASSISTANCE  
PARTNERSHIPS

# Biomass and Rural Power System Upgrade Fort Yukon, Alaska

## 2,540 kW Community Energy System



Fort Yukon's New David Lee Thomas Combined Heat and Power Building

### Site Description

Fort Yukon is located north of the Arctic Circle, about 145 miles by air northeast of Fairbanks. Residents of the Native Village were seeking a better, less costly way to heat the village's common buildings and shared water system. Like many village power systems, the power plant at Fort Yukon consisted of multiple diesel generators that were installed as electric loads increased. These varied in efficiency, quality, and dependability. Major buildings were generally independently heated with fuel oil-fired boilers. Both types of equipment use expensive fuel oil being barged in, with current wholesale prices of \$4.54/gallon and often higher. Unsubsidized residential electricity costs in Fort Yukon can cost up to \$0.65/kWh.

### Quick Facts

**LOCATION:** Fort Yukon, Alaska

**MARKET SECTOR:** Community power and district heating system

**COMMUNITY SIZE:** Population 650

**FACILITY Total Electrical Energy**

**Generation:** 3,130,000 kWh/year

**EQUIPMENT:** Four reciprocating engines, including two used 920 kW CAT 3508B and two refurbished 350 kW Detroit Diesel Series 60 units

**FUEL:** Diesel oil-fired

**USE OF THERMAL ENERGY:** District heating loops serving 7 community buildings

**CHP TOTAL EFFICIENCY:** Meets 100% of electrical loads and 65%-75% of district heating system thermal loads (up to 100% when a new wood-fired boiler is included).

**YEARLY ENERGY SAVINGS:** 66,000 gallons per year of diesel fuel

**CHP IN OPERATION SINCE:** February, 2017

### Reasons for CHP

The Fort Yukon project evolved from initially being comprised of a wood-fired boiler for the schoolhouse; to a wood-fired boiler serving a district heating system; to a new utility powerhouse with diesel generators tied into a district heating loop. The CHP and district heating project was jointly developed by the Council of Athabascan Tribal Government; the Gwitchyaa Zhee Gwichin Tribal Government, and the Gwitchyaa Zhee Corporation (GZC). The new power plant provides Fort Yukon with a reliable and more efficient source of electrical energy plus redundant sources of thermal energy. Both the engine-generator and a new wood chip-fired boiler are tied into a new district heating loop serving the downtown core, which includes a school and a gym; school administration building and shop, the city's water treatment plant, the public radio station, and the state multi-use building.

The new powerhouse and biomass boiler are co-located near the downtown core. The combined CHP project including the district heating loop and biomass boiler was funded by over \$9 million in grants from multiple sources including the U.S. DOE's Tribal Energy Program, the Alaska Renewable Energy Fund (managed by the Alaska Energy Authority); the Denali Commission, and the U.S. Department of Agriculture Rural Utility Service.

## CHP Equipment & Configuration

Project elements include the district heating loop, requiring installation of below grade pre-insulated arctic piping; a powerhouse with four diesel generators having a total generating capacity of 2,540 kW; automated switchgear to provide paralleling and load control; a 20,000 gallon insulated and heated double wall diesel fuel storage tank with fuel transfer equipment; a heat recovery system, a fire suppression system, and two 750 kVA step-up transformer banks. A 3.2 MMBtu/hour wood chip-fired boiler equipped with chip storage and a wood storage yard is also provided to meet additional district heating system thermal loads.



**Two 350 kW Detroit Diesel engine gensets (above) were removed from the old powerhouse, remanufactured and “marinized” (cooling system modified for water heating).**

## CHP Design, Installation, and Operation

Engineering was provided by Gray Stassel Engineering of Anchorage. Site preparation included sub-excavating and removal of 8-feet of frost susceptible soils and backfilling with 17-feet of clean structural fill to elevate the powerhouse above the 100-year flood plain. The new powerhouse contains two 350 kW Detroit Diesel engine/generators that were salvaged from the old generating station and two used (low hour) 920 kW Caterpillar 3508B gensets.

Biomass is available from GZC’s vast forest holdings that are untapped commercially due to the lack of viable markets. Approximately 80 to 100 acres is harvested annually to provide up to 700 tons of wood chips needed on an annual basis to meet supplemental thermal loads on a sustainable yield basis. A four-month supply of wood fuel will be maintained in the wood storage yard for reliability and resiliency reasons.

## CHP Project Benefits

The overall project provides stable jobs, rural economic development, wildfire mitigation, habitat enhancement and local renewable energy benefits. The project will also help to provide fuel price stability. The goal of the district heating loop is to displace up to 90% of the fuel oil used by the buildings that are connected to the network. A building fuel use reduction of 66,000 gallons/year is expected which would result in a diesel fuel savings of \$300,000, given a wholesale diesel fuel cost of \$4.54/gallon at the site. The CHP project is expected to produce about 3,130,000 kWh annually with recovered thermal energy provided to the heat utility at a price of \$5/MMBtu, which is far lower than the price of other thermal energy options at this site.

## Maintenance Requirements

The Gwitchyaa Zhee Utility Company has long operated and maintained diesel engine generators to serve local electrical loads. They also schedule fuel orders and deliveries, monitor electrical meters, and collect fees.

## For More Information

### U.S. DOE Northwest CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)

David Van Holde, Director  
(360) 956-2071

[VanHoldeD@energy.wsu.edu](mailto:VanHoldeD@energy.wsu.edu)

More CHP Project Profiles:

[www.nwchptap.org/](http://www.nwchptap.org/)

Date produced: 2019

Alan Feters

Rural Assistance Manager

Alaska Energy Authority

(907) 269-4684

***Even with buried insulated arctic piping, heat losses associated with long pipe runs must be considered. Tees were installed on the district heating loop piping so additional buildings can be added in the future.***

***---Steve Stassel, Gray Stassel Engineering***