Northwest CHP Application Center

Combined Heat and Power for the states of Alaska, Idaho, Montana, Oregon and Washington in cooperation with the U.S. Department of Energy

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ALASKA ENERGY AUTHORITY

ANGOON, ALASKA, POWER PLANT AND RECOVERED HEAT FACILITIES

Facility Description

The Inside Passage Electric Cooperative (IPEC) operates the electric utility in Angoon, Alaska. The power plant is a 60'x30' pre-engineered steel building with concrete perimeter foundation and slab on-grade floor that was constructed in 1984, *see Figure 1*. The existing generation heat recovery system was installed in 1990. Much of the existing generation and heat recovery equipment is now due for replacement. A generation equipment and heat recovery system renovation design has been completed and an upgrade project is scheduled for 2007. This report is based on the proposed new renovated system which will include one new generator and a complete new engine coolant system as well as all new generation heat recovery equipment and piping. The power plant will be equipped with three diesel generators for a total capacity of 1,585 kW. Power will be generated at 480V and provided to the community via three phase 7.2/12.47kVA step-up transformers and a three-phase overhead distribution system. The 2005 annual electric generation was approximately 2,021,000 kWh, *see Figure 2.*

Heat from the diesel generator cooling system is used to heat the power plant control room and is pumped through below grade insulated arctic pipe from the power plant to five separate school facility buildings, *refer to Figure 3 and attached site plan and schematic*. A total of six heat exchangers, one located in the power plant and one in each of the remote buildings, isolate the generator cooling system from the arctic piping and remote building hydronic heating systems.

Combined Heat and Power (CHP) Equip.

<u>Power Plant</u>

- Generators (#2 diesel fuel engines)
  - Caterpillar 3456ATAAC 475 kW
  - Caterpillar 3508DI 550 kW (existing)
  - Caterpillar 3508DITA 560 kW (existing)
- Heat Exchanger (HX-1), plate & frame, 400 MBH, Ameridex X-35-69
- Circulating pump (P-HR1, P-HR2), 35 gpm @ 21' TDH, 3/4 hp, 230V, 1 phase, Grundfos UPS40-80/2

Figure 1: Angoon Power Plant

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End Users

- Elementary School
  - o Heat Exchanger (HX-2), brazed plate, 50 MBH, Ameridex
  - o 1 existing boiler
- Teacher Housing
  - o Heat Exchanger (HX-3), brazed plate, 40 MBH, Ameridex
  - o 1 existing boiler
- Elementary School Gymnasium
  - o Heat Exchanger (HX-4), brazed plate, 60 MBH, Ameridex
  - o 1 existing boiler
- High School Gymnasium
  - o Heat Exchanger (HX-5), brazed plate, 105 MBH, Ameridex
  - o 2 existing boilers (B-1 & B-2)
- High School
  - o Heat Exchanger (HX-6), brazed plate, 95 MBH, Ameridex
  - o 4 existing boilers (B-1, B-2, B-3, B-4)

Estimated Fuel Savings

The renovated heat recovery system will provide heat to five school facility buildings. After the power plant upgrade project is complete the prime community generator will be the new Caterpillar 3456. This unit will have an air cooled charge air cooling system and will therefore reject less heat to the jacket water than the Caterpillar 3508 generators that are currently in use. This will decrease the amount of heat available to the generation heat recovery system slightly but will generate net overall fuel savings due to the increased generation efficiencies expected at normal community loads. The renovated heat recovery system is expected to save the school an estimated 16,800 gallons of heating fuel per year, *see Figure 4*.

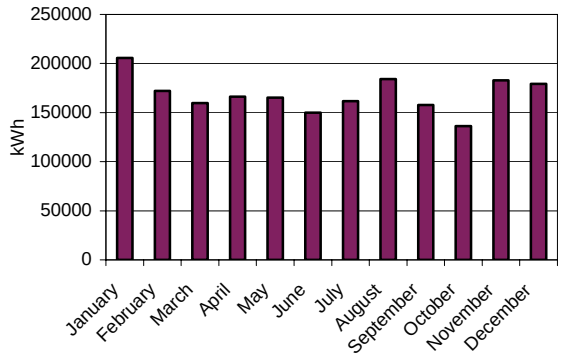

Figure 2: Electric Generation Profile

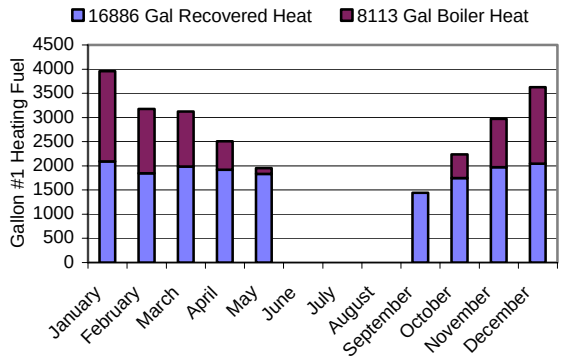

Figure 4: Thermal Energy Provided

Figure 3: Recovered Heat System

Additional Considerations

The community should operate the older of the two existing 3508's (Gen #2) as the second unit to save hours on the newer 3508 (Gen #1). When Gen #2 is ready for replacement a second 3456 should be considered for installation to maximize generation efficiency.