



CHP
TECHNICAL ASSISTANCE
PARTNERSHIPS

Army Aviation Support Facility

75 kW CHP System

Site Description

The Maine Army National Guard (ARNG), located in Bangor Maine, trains troops who are assigned to critical missions including medical evacuation, air assault, security and support, and search and rescue. In 2015, the ARNG installed a 75 kW combined heat and power (CHP) system at the 123,500 square foot (sq. ft.) Army Aviation Support Facility (AASF) on the east side of the base, and recently a 35 kW CHP system at the 70,000 sq. ft. Armed Forces Readiness Building (AFRB) on the west side of the base. A 43 kW roof-mounted solar photovoltaic (PV) array in combination with the 75 kW of CHP has reduced energy consumption by 30% and produces roughly 65% of the facility's power requirements.

After four full years of operation, the facility is seeing average annual savings near \$60,000 from the CHP system. The system also reduces the facilities CO₂ emissions by about 100 tons per year, approximately the amount of emissions generated by 14 houses purchasing electricity from the grid.

Quick Facts

LOCATION: Bangor, Maine
MARKET SECTOR: Mission critical Army base
FACILITY SIZE: 123,500 square feet
FACILITY PEAK LOAD: 175 kW
EQUIPMENT: 75 kW AGEN V8 reciprocating GM engine with induction generator;
 43 kW solar PV
FUEL: Natural gas
USE OF THERMAL ENERGY: Hot water radiant floor for space heating
CHP PEAK EFFICIENCY: 85%
CHP ENVIRONMENTAL BENEFITS: 100 ton reduction in CO₂ emissions annually
CHP PROJECT COST: \$425,000
CHP ANNUAL SAVINGS: \$60,000
CHP PAYBACK: 7.3 years
CHP IN OPERATION SINCE: 2015

Reasons for Installing CHP

Prior to 2015, electricity was purchased from the grid and thermal energy provided by on-site natural gas-fired boilers. Bangor's AASF was chosen as a pilot project by the Maine National Guard to understand the economic benefits of replacing an existing boiler with a CHP system in regions having more than 5,000 heating-degree-days annually in buildings larger than 50,000 sq. ft. The AASF is just one of 1000 buildings within the Army National Guard across the U.S. that fits this description, potentially reducing costs while improving resiliency, reliability, and environmental benefits.



Army Aviation Support Facility in Bangor, Maine

PHOTO COURTESY OF bangordailynews.com

CHP Equipment & Operation



Aegis 75 kW CHP system including a reciprocating engine and induction generator.

PHOTO COURTESY OF NECHP Team

The Aegis Energy Services' pre-packaged system includes a natural gas-fired V8 internal combustion engine coupled to an induction generator that produces 75 kW of electricity at full capacity. The waste heat is routed from the engine's exhaust to heat water that runs through 45,000 sq. ft. of flooring for radiant heat. In addition to the radiant heating system, the otherwise rejected heat is routed to a condensing unit and air handler. This efficient use of heat allows the site to keep one boiler off for the full heating season and shorten the amount of time the other two boilers are used, reducing fuel usage. The 43 kW solar PV array further reduces the amount of electricity the facility needs to purchase from the grid by roughly 94,000 kWh annually.

Based on this project's data, the ARNG concluded that CHP is a viable option to reduce fuel consumption and emissions at up to 500 Army aviation and ground vehicle support facilities across the U.S. With the success of the ARNG's 75 kW Aegis system, the ARNG has recently incorporated a 35 kW Yanmar CHP system servicing the 70,000 sq. ft. AFRB on the west side of the base. Two 10 kW CHP systems will also be installed at the base in Presque Isle, Maine, to service a 50,000 sq. ft. facility.

“When installing CHP, characterize the system for the thermal load. The electricity is just an added benefit.”

**- A.J. Ballard
Project Engineer**

Honors and Awards

The ARNG has received multiple awards, including:

- In 2016, the Environmental Protection Agency's Energy Star CHP Award based on efficiency and air emission reductions.
- In 2017, the Secretary of the Army Energy and Management Award for Innovation and New Technology.

Lessons to Share

Prior to 2017, the electric meters were stationed in three separate locations on the Army Aviation Support Facility. In 2017, the meters were brought in line with each other to net-meter excess electricity that is produced by the facility. The ability to net-meter resulted in 99.5% CHP operation during the entire 2017-2018 heating season because the system could run at design conditions even when electric demands were low. The facility net-meters about 5,000 kWh of electricity per month at approximately eight cents per kWh.

A critical step for a successful installation of a CHP system is to have a feasibility study. A feasibility study should include the goals and needs of the end user in addition to advising on the appropriate size of a CHP unit to be able to fully use the thermal energy produced by the system. Finding a viable use for all of the heat produced by the system is essential to making the project cost-effective and maximizing efficiency.

For More Information

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