



Fort Knox

8 MW Natural Gas CHP System for Critical Infrastructure

Project Overview

Fort Knox located south of Louisville and north of Elizabethtown in Kentucky, was established in 1918. It is a certified Kentucky city, covering 109,054 acres in three counties with a population of approximately 10,000. Throughout the years, the post hosted the mechanized cavalry headquarters, the armored force headquarters, and served as a prisoner of war camp during WWII. Fort Knox is currently home to such organizations as U.S. Army Cadet Command, U.S. Army Recruiting Command and U.S. Army Human Resources Command; and as such, is considered the Army's human capital hub.



Fort Knox partnered with Nolin Rural Electric Cooperative Corporation (RECC), who subcontracted with Harshaw Trane, to deliver an energy security microgrid project that incorporates 44 MW of new power generation, comprised of 8 MW of CHP natural gas generators, 16 MW of peak-shaving natural gas generators, and 20 MW of diesel emergency backup generators. The newly installed CHP generators are deployed at three different sites on post, chosen for being critical infrastructure and prime locations for the thermal load produced by the CHP systems. Natural gas is partially supplied from the Devonian Shale that lies underneath Fort Knox, through a utility privatization contract held by Nolin RECC.

Quick Facts

LOCATION: Fort Knox, KY
MARKET SECTOR: Military/Hospital/Data Center
FUEL: Natural Gas
MAX CAPACITY: 8.2 MW
IN OPERATION SINCE: 2014
EQUIPMENT: (4) 2.05 MW CAT 3520C Reciprocating Engines
 (2) 3,800 lb/hr Johnston Waste Heat Recovery Boiler
 (3) Thermax Absorption Chillers totaling 1,840 tons
USE OF THERMAL ENERGY: Steam, Hot water, Chilled Water
ESTIMATED ANNUAL SAVINGS: \$4,979,054
SIMPLE PAYBACK: 7.5 years
JOINT PROJECT BY: Fort Knox, Nolin RECC, and Harshaw Trane
ENVIRONMENTAL BENEFITS: 90% removal of NO_x, 93% reduction of CO, 80% removal of formaldehyde
EFFICIENCY: 81%
EMISSIONS CONTROLS: SCR and Pre-oxidation housing for emission control

Reasons for Installing Combined Heat & Power

In 2009 a major ice storm hit Fort Knox with severe effects. The post lost its connection to the local utility and several buildings went without power for as long as 10 days. Energy security and reliability being a concern, CHP was installed to provide power not only on a day-to-day basis, but also serve as reliable backup power in case of emergency. The systems will reduce the peak demand of the post and, as a result, the peak of the local utility, Louisville Gas & Electric. Peak monthly demand at the LG&E billing meter will be managed to achieve the lowest cost of delivered power.

Compliance with Federal energy mandates, such as EISA 2007 and Executive Order 12423, was a motivating factor for CHP deployment. Fort Knox has set a goal to become a net zero Army post by generating onsite as much energy as it consumes. CHP is an important tool to achieve this goal and ensure power reliability.

Equipment and Configuration

Each CHP system is comprised of a lean burn natural gas reciprocating engine. The specific engine was chosen for its ability to vary loads and have multiple start and stops. SCR and Pre-oxidation housing for emission control was installed on all three CHP systems. The three different facilities where CHP is deployed are:

1. The Ireland Army Community Hospital

It includes two 2 MW reciprocating engines (CAT 3520C), two custom made Johnston waste heat recovery boilers producing 3,800 lb/hr of medium pressure steam (72 psig), and a Thermax absorption chiller that produces 640 tons of absorption cooling from hot water recovery. The system was installed to create fully redundant heat, chilled water, and power production for the hospital.

2. The 160,000 sq.ft. Data Center:

The system was placed to provide both day-to-day and emergency power. It consists of one 2 MW reciprocating engine (CAT 3520C), and a 705 ton Thermax absorption chiller. The chiller is exhaust and hot water driven and serves the computer room air conditioning units.

3. The Post Exchange (Retail Center):

The system is a 2 MW reciprocating engine (CAT 3520C) with a 495 ton Thermax absorption chiller. The exhaust recovery produces chilled water, and the hot water recovery from the engine produces 6.5 MMBtu/hr of hot water at 180°F.



Collaborative Partnership

This CHP project was developed through a collaborative effort between Fort Knox, Nolin RECC, and Louisville-based Harshaw Trane. Nolin, the base electrical privatization contract holder, has a 50-year contract with Fort Knox to operate and maintain the grid on the base. The project became feasible after Nolin secured a loan from the National Rural Utilities Cooperative Finance Corporation (CFC) for both the microgrid and the 44 MW of new onsite generation. The Kentucky PSC approved the loan and construction of the project, and Fort Knox performed the project under the privatized contract.

Lessons Learned

Early coordination with the EPA and state environmental permitting authorities can help identify potential issues, streamline the permitting process and avoid changes in design plans that can become costly. For example, different prerequisites in air treatment can change the requirements in heat exchange equipment downstream of the emission control equipment.

For More Information

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