PROJECT PROFILE

National Animal Disease Center

4.7 MW CHP System

Project Overview

Located in Ames, Iowa, the National Animal Disease Center (NADC) is the largest federal animal disease center in the U.S. The NADC conducts research to solve animal health and food safety problems faced by livestock producers and the public. Opened in 1961, the NADC today includes over one million square feet of laboratory, animal housing, administrative and other support facilities.

NADC's first experience with combined heat and power (CHP) began in 2002 when they installed a 1.2 MW CHP plant. That system utilized a Solar Saturn 20™ natural gas fueled combustion turbine with heat recovery from the turbine exhaust gases. The exhaust gases are recycled through a heat recovery steam generator (HRSG) to produce 8,300 lbs/hr of process steam for use in the facility laboratories. The HRSG is also equipped with additional natural gas fired duct burners that can boost the thermal output to 29,000 lbs/hr of steam to satisfy both the process and space heating requirements of the Center. When installed, the thermal capability of the CHP system allowed the NADC to completely avoid operating an existing 40-year-old 70% energy efficient boiler (now used strictly as a backup boiler for added reliability).

Quick Facts

LOCATION: Ames, Iowa
FACILITY SIZE: Over One Million Square Feet
CHP GENERATING CAPACITY: 4.7 Megawatts
PRIME MOVERS: 1.2 MW Solar Saturn 20™ Combustion Turbine (CT-1), 3.5 MW Solar Centaur 40™ Combustion Turbine (CT-2)
HEAT RECOVERY RATE:
CT-1: 8,300 lb/hr Steam Unfired; 29,000 lb/hr Steam with Duct Firing
CT-2: 23,500 lbs/hr
USE OF THERMAL ENERGY: Steam for Laboratories, Space Heating, Absorption Chillers
FUEL: Natural Gas
BEGAN OPERATION:
2002 – 1.2 MW CHP System (CT-1)
2007 – 3.5 MW CHP System (CT-2)

Due to the success of the first system (CT-1), NADC installed a second 3.5 MW CHP gas turbine in 2007 (CT-2). The exhaust gases from the second turbine are also recycled and sent through a HRSG producing 23,500 lbs/hr of process steam. Unlike with CT-1, the HRSG on CT-2 does not have duct firing and only operates when the turbine is in operation. Currently, this unit provides base load power to the facility while CT-1 operates only during peak periods.

Reasons for CHP

An opportune time for an organization to consider investing in a CHP system is during new facility construction or during a major facility/boiler room upgrade. In 2001 the NADC was in such a situation. Its existing boiler plant was 40 years old and the maintenance and fuel costs on the 70% efficient boiler were becoming an issue. An analysis of the total facility's energy requirements revealed several conditions favorable for consideration of a CHP system:

NADC CHP Facility

- Simultaneous and balanced electric and thermal loads
- Concerns over electric reliability and rising energy costs
- Aging equipment (boilers and chillers)

Solar Centaur 3.5 MW System

With limited capital improvement project funds available to make a multi-million dollar investment, the NADC turned to Johnson Controls (an energy services company) and a funding mechanism called energy service performance contracting (ESPC) to finance a CHP system.

In 2007 the situation was very different. Congress had just authorized over $50 million in spending to modernize the existing NADC and National Veterinary Services Laboratory / Center for Veterinary Biologics (NVSL/CVB) Research Facilities in Ames, Iowa, creating the new National Center for Animal Health. The total project consisted of the construction of over one million ft^2 of new laboratory, animal housing, and administrative and other support facilities. Funds for this expansion included funds for new chillers and a new boiler plant that included the new 3.5 MW turbine. This new turbine helped offset the increased electric load from the newly revamped and modernized site, and also provided increased energy security and reliability.

CHP is crucial for the NADC because the facility houses BSL2 and BSL3 level laboratories, the third and second highest Biosafety Level risk categories, respectively. Containment is critical because of the infectious nature of these diseases. The labs used for BSL2 and BSL3 testing cannot lose power no matter the circumstance. The two combustion turbine CHP systems offer a secure and reliable power supply that will continue to run in case of an emergency; the NADC also has five 2.5 MW diesel backup generators on site that provide further redundancy.

Improving Indoor Air Quality

Many of the animal research areas need to meet animal care standards and require High Efficiency Particle Air (HEPA) and other air filtration methods that requires many air changes per hour to meet standards. In addition to maintaining high levels of indoor air quality (IAQ) for the animals, the NADC wanted to improve the air quality for its 270 employees. Increasing the IAQ throughout the center increases employee productivity, increases employee safety and health, and lowers employee absenteeism and turnover rates.

The penalty associated with such a high number of air changes per hour throughout the center is the increased energy requirements to thermally treat the outside air (heating, cooling, dehumidifying). This is where the benefits of a CHP system are further highlighted. The high and relatively constant thermal requirements allow for maximum use of the heat from the CHP system. When utilizing the recycled heat from the turbine exhaust gases and the supplemental duct burners, the CHP efficiency reaches up to 92%.

> ***"Our tremendous energy savings is accompanied by improvements in operation and maintenance designed to keep the NADC running smoothly and meeting its goals for years to come."***
>
> ***- Dennis Jones, NADC Facility Engineer***

For More Information

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