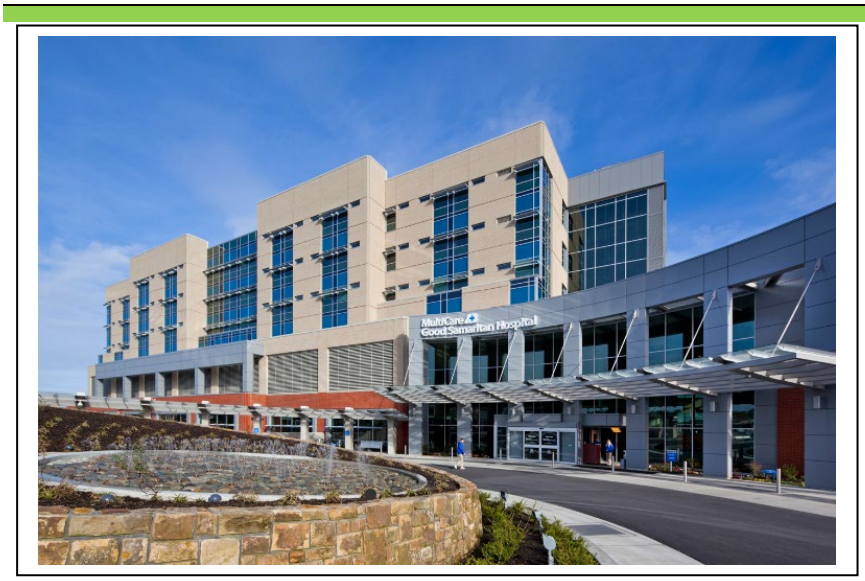
NORTHWEST

CHP
TECHNICAL ASSISTANCE
PARTNERSHIPS

PROJECT PROFILE

MultiCare Good Samaritan Hospital, Puyallup, WA

2-MW Packaged CHP System



A 2 MW reciprocating engine CHP system at Puyallup's MultiCare Good Samaritan hospital provides steam and hot water requirements.

Quick Facts

LOCATION: Puyallup, Washington
MARKET SECTOR: Hospital
FACILITY SIZE: 350 beds
FACILITY Total Electrical Energy Use: ~14.5 million kWh/year
EQUIPMENT: 2 MW lean burn reciprocating engine with waste heat recovery in the form of 70-psig steam and 180°F hot water
FUEL: Natural gas-fired
USE OF THERMAL ENERGY: Waste heat recovery in the form of steam and hot water
CHP TOTAL EFFICIENCY: About 86.4% when all waste heat is utilizable
CHP IN OPERATION SINCE: July, 2020

Site Description

MultiCare Good Samaritan hospital is located in Puyallup, WA, about 36 miles SE of Seattle, WA. The 350-bed facility offers a full spectrum of medical services. Thermal loads at the hospital were originally met with natural gas-fired steam boilers with hot water converters serving space and domestic hot water heating requirements. Steam is used for medical equipment sterilization, laundry, and cooking needs.

Reasons for CHP

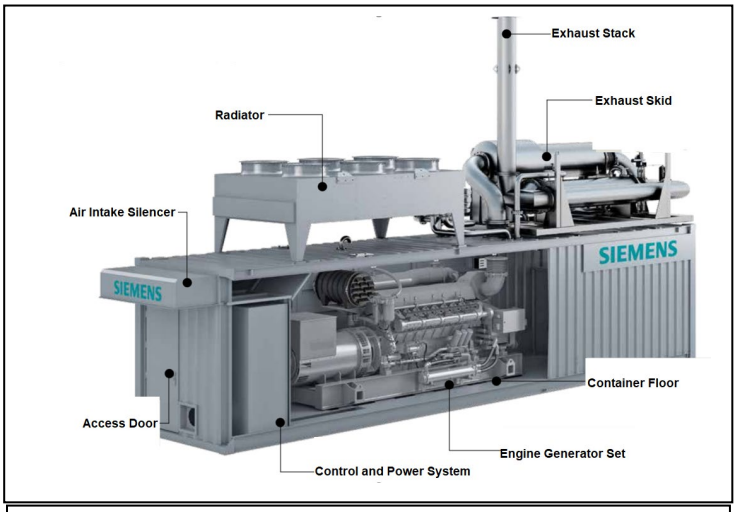
In 2015, Good Samaritan consumed 19.9 million kWh of electrical energy and 93,562 MMBtu of natural gas. Peak electrical demand was 4.55 MW. Total annual electrical energy and transport natural gas costs at that time exceeded $2.0 million. In 2016, the Northwest CHP TAP conducted a qualification screening that indicated the site was a good candidate for CHP; hospitals are often excellent candidates for CHP due to coincident electrical and thermal loads and continuous (8,760 hours per year) annual operation. The hospital's primary motivation for exploring CHP was to reduce operating costs by generating electrical energy at a lower cost than that offered through local utility rates.

Good Samaritan then retained McKinstry Engineers to conduct energy flow monitoring and take hospital expansion into consideration while preparing an investment-grade model for CHP project sizing, configuration, and operating modes. This study was used as the basis for the decision to move forward. The Martin Energy Group (MEG) was retained in a competitive bidding process to develop design documents and manage project development. The agreement with MEG included preparing project specifications; CHP equipment selection; project management and installation services; providing startup and commissioning, as well as providing maintenance services for a 2 MW Siemens EM Series, lean-burn, spark-ignited natural gas-fired reciprocating engine and associated waste heat recovery equipment.

CHP Equipment & Configuration

The 2 MW 1200 RPM direct drive Siemens reciprocating engine-based CHP system is marketed as a "plug and play" unit that is delivered in a shipping container. The electronically-carbureted unit is factory-assembled and tested and includes an engine control and diagnostics monitoring system plus required air emissions control equipment, including a urea injection system and an oxidation catalyst.

This packaged system features ultra-high efficiency performance, with 3.6 MMBtu/hour of 180°F hot water supplied from both water jacket and intercooler heat exchangers, and up to 3 MMBtu/hour of 70-psig steam produced from the hot engine exhaust.



The 2 MW Siemens gas-fired reciprocating engine has a minimal footprint as it is mounted in a shipping container

CHP Design and Installation

The packaged CHP project is located outside of the boiler house in a fenced, previously unused space. The unit Installation consisted of pouring a concrete pad, sliding the shipping container into place and making electrical, steam and hot water and controls/communications connections. Small tanks were provided for crankcase oil and urea storage. The system required substantial site engineering effort, however, as fuel, steam, and hot water interconnections as well as electrical protection (including back-feed prevention) all needed design and construction. Puget Sound Energy provided a financial incentive for this high-efficiency CHP project through its Cogeneration/Combined Heat and Power grant program.

CHP Operation and Emissions Control Requirements

The CHP project is generally operated at its full rating to maximize power output and electrical energy generation. It is not designed to operate in a stand-alone or "island" mode as the hospital has both electrical energy resiliency and redundancy provided through existing emergency generators (3-2,000 kW units, one 1,500 kW unit, and one 1,000 kW unit). The hospital did not want to induce load serving conflicts between the CHP project and the existing emergency generators, so the CHP unit is specifically designed to shut down when the facility loses utility power.

The hospital worked with both EPA Region 10 and the Puget Sound Air Pollution Control Agency's Advisory Board to identify emissions control system requirements. An oxidation catalyst is used and DEF (diesel exhaust fluid, a non-hazardous blend of 32.5% urea and 67.5% de-ionized water) is sprayed into the exhaust stream to break NOx emissions down into nitrogen and water.

Maintenance Requirements

On-site staff conduct oil changes and change out spark plugs as required. The Siemens control system can E-mail warning reports and provide detailed diagnostics for troubleshooting. This allows for quick intervention in the event of a variation of a controlled parameter. A major overhaul is required every 90,000 hours.

MultiCare is the first hospital in Washington State to install and operate a CHP system. The former MultiCare Manager of Engineering Systems states, "It was a privilege to be part of the CHP project".

---Clay Ciolek, MultiCare Facilities Management and Operations Support

For More Information

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Other CHP Project Profiles
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