RAISING THE BAR IN ENERGY EFFICIENCY

BOILER DIVISION CASE STUDY

Leland Stanford Junior University

Stanford, CA

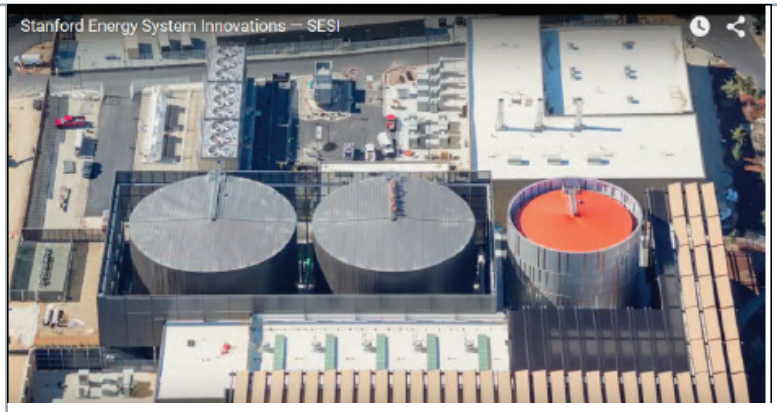
New HWG Boilers and Pumps

CUSTOMER APPLICATION AND KEY CHALLENGES

Stanford released an Energy and Climate Action plan aimed at raising the bar in energy efficiency and the use of innovative, clean, and renewable energy. Including high-efficiency standards for new buildings; continued efficiency improvements for existing buildings; and the cutting-edge energy supply system known as the Stanford Energy System Innovations (SESI) project.

SESI required transforming a 100 percent fossil-fuel-based combined heat and power plant to grid-sourced electricity and a more efficient electric heat recovery system. The heat recovery involved capturing waste heat from the district chilling system to produce hot water for the district heating system. This was done through the use of industrial heat recovery chillers and conversion of the campus heat distribution system from steam to hot water.

Supplemental hot water generators were required in the event heat recovery chillers went down or during scheduled maintenance. As part of the entire SESI project, new pumps were also provided for both the hot, chilled and condensing water systems. All to be completed before the retiring Central Plant shut down.



SESI Central Energy Facility at Stanford University.

THE R.F. MACDONALD CO. ANALYSIS & SOLUTION

In order to provide a timely, reliable, cost effective and energy-efficient boiler system that met the required heating load, R.F. MacDonald Co. recommended three Cleaver-Brooks CBEX Elite Firetube boilers. The largest, cleanest burning and most energy efficient Firetube boilers on the market, each boiler is rated at 1800 bhp with a heat input of 69.4 MMBTUH.

A Cemtek CEMS package to continuously monitor NOx emissions and stack O2 was supplied to ensure that the hot water generators are operating at peak efficiency with clean combustion.

Variable Frequency Drives were provided on the 60hp burner fan motors to improve performance and reduce energy consumption

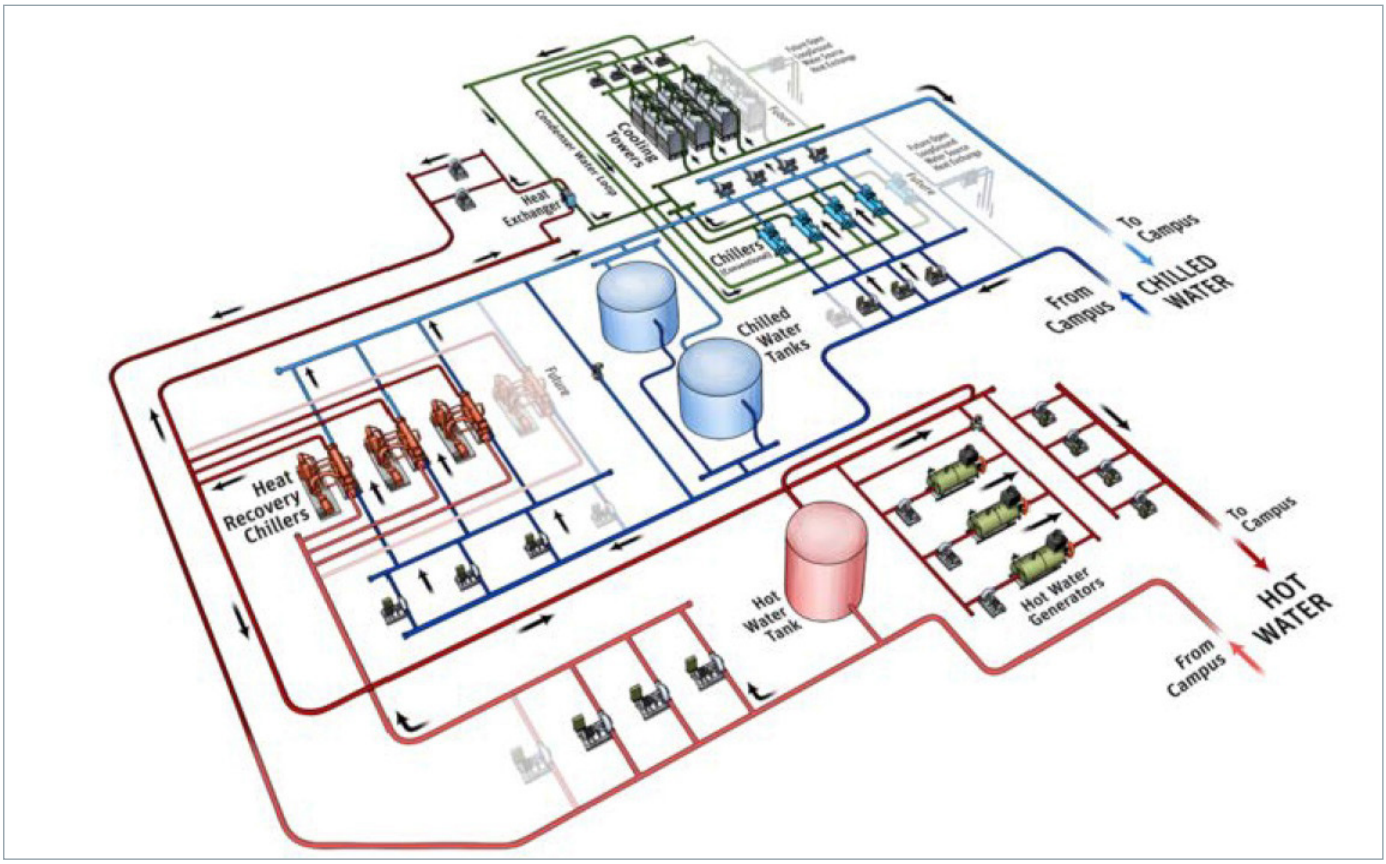
Hot Water Generator

THE R.F. MACDONALD CO. ANALYSIS & SOLUTION (Cont.)

ITT/ Goulds pumps were selected to manage the hot, chilled and condenser water flows. Twenty-six pumps in total were used. Models were 3410 XL, 3420, and 3498, varying in horsepower from 75 to 600hp, and flows from 4,000 to 14,500 GPM.

The schematic shows all the twenty-six Goulds pumps. All pumps had variable frequency drives to improve electrical energy efficiency

The hot water return from campus goes into a common header at the Central Plant, as shown on the Process Schematic, going to either the heat recovery chillers, or the hot water storage tank. Processed hot water is then routed to the campus via secondary heating water pumps. In the event that hot water needs to be augmented, dedicated primary heating water pumps, pump it through the hot water generators.



SESI Central Energy Facility Process Schematic

This use of chiller heat recovery and large storage volumes of hot and chilled water allows the flexibility to generate chilled water in the evening and night when electrical demand is low which improves the electrical grid efficiency and reduces electrical energy costs for the University.

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PROJECT RESULTS

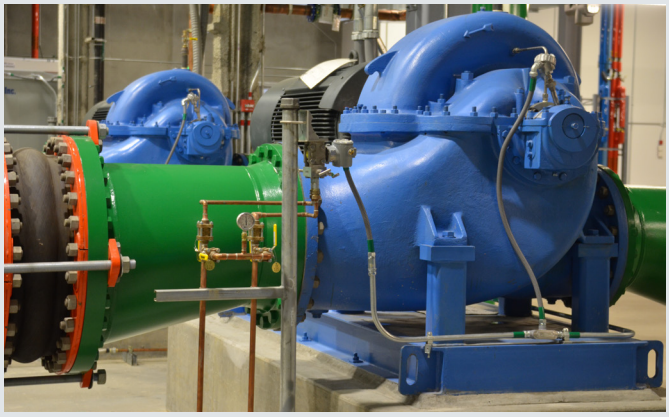
Stanford's system is one of largest hot water boiler systems of its type. After successful assembly and installation, R.F. MacDonald Co. worked in conjunction with Cleaver-Brooks factory techs on commissioning the units. The overall hot water system was brought on-line, before the shut down of the retiring Central Plant, taking the heating loads to meet the campus requirements.

The Cleaver-Brooks hot water boilers met the Bay Area Air Quality Management District emissions requirements, of 9ppm NOx firing on natural gas, and 40ppm NOx on amber fuel oil.

Stack economizer and inlet air pre-heater boosted performance to 86% Fuel-to-Hot Water efficiency on natural gas, and 90% on amber fuel oil.

Dual fuel burning capability, of natural gas and amber fuel oil, was included to allow operation in the event natural gas was interrupted.

Extensive interface with the plant-wide Johnson Controls DCS for communication control and remote operation was accomplished. The boilers successfully responded to varying heating loads, thus achieving one of the main objectives.



Example of one of the twenty six Goulds pumps installed