2016 Building 6 Efficiency & Controls Project

Saving energy, improving building controls, and stabilizing temperature

Project Overview

The goals of the Building 6 Efficiency & Controls Project were to save energy, upgrade building controls, and improve the ability to regulate temperature in the Advanced Light Source (ALS) experiment hall. Due to broken sensors and malfunctioning systems, the facility had been experiencing temperature instability. In addition, energy and heat was being wasted through excess simultaneous heating and cooling. This project presented an opportunity to provide energy and cost savings, as well as a positive impact to the Lab's scientific mission.

Background and Approach

The Advanced Light Source (ALS) is arguably the most iconic building at Berkeley Lab. Completed in 1993, the facility attracts hundreds of scientists worldwide each year to conduct a wide range of hard and soft X-ray experiments.

By the start of FY17, the building control system was becoming antiquated, many temperature sensors were defective, and the boiler system was not working effectively. Many systems were not functioning properly and it was getting harder to maintain a consistent temperature in the work areas.There was also a lot of energy being wasted. To address these issues, a project team was assembled from Sustainable Berkeley Lab and the Facilities Division, with consulting support from kW Engineering, and close coordination with the ALS operations team.

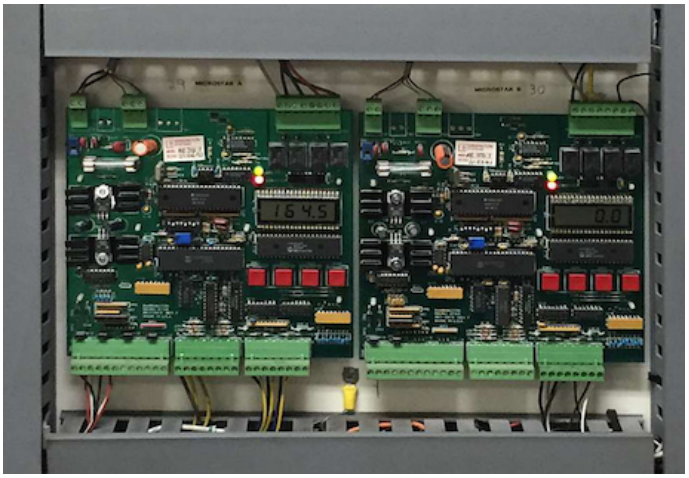
The Advanced Light Source (ALS) Building

The team faced a unique set of challenges, in addition to the typical ones of cost, schedule, staffing, and maintaining safety. To start, a large, joint, Facilities-Sustainability project of this size had not previously been attempted. The project also had some unique constraints. For example, project work had to avoid impacts on the operation of the ALS. Significant portions of the work had to be done during maintenance "shutdown" periods, which were typically two days every two weeks. Finally, upgrades to critical parts of the building had to be structured so that they

could be reversed quickly at the end of the two-day shutdown if they were not completed or if system tests failed. To address this last requirement, the lead project engineer built custom wiring harnesses to allow fast reconnection with the old Barrington control system.

Over the course of the next year, retro-commissioning and upgrades were conducted, including:

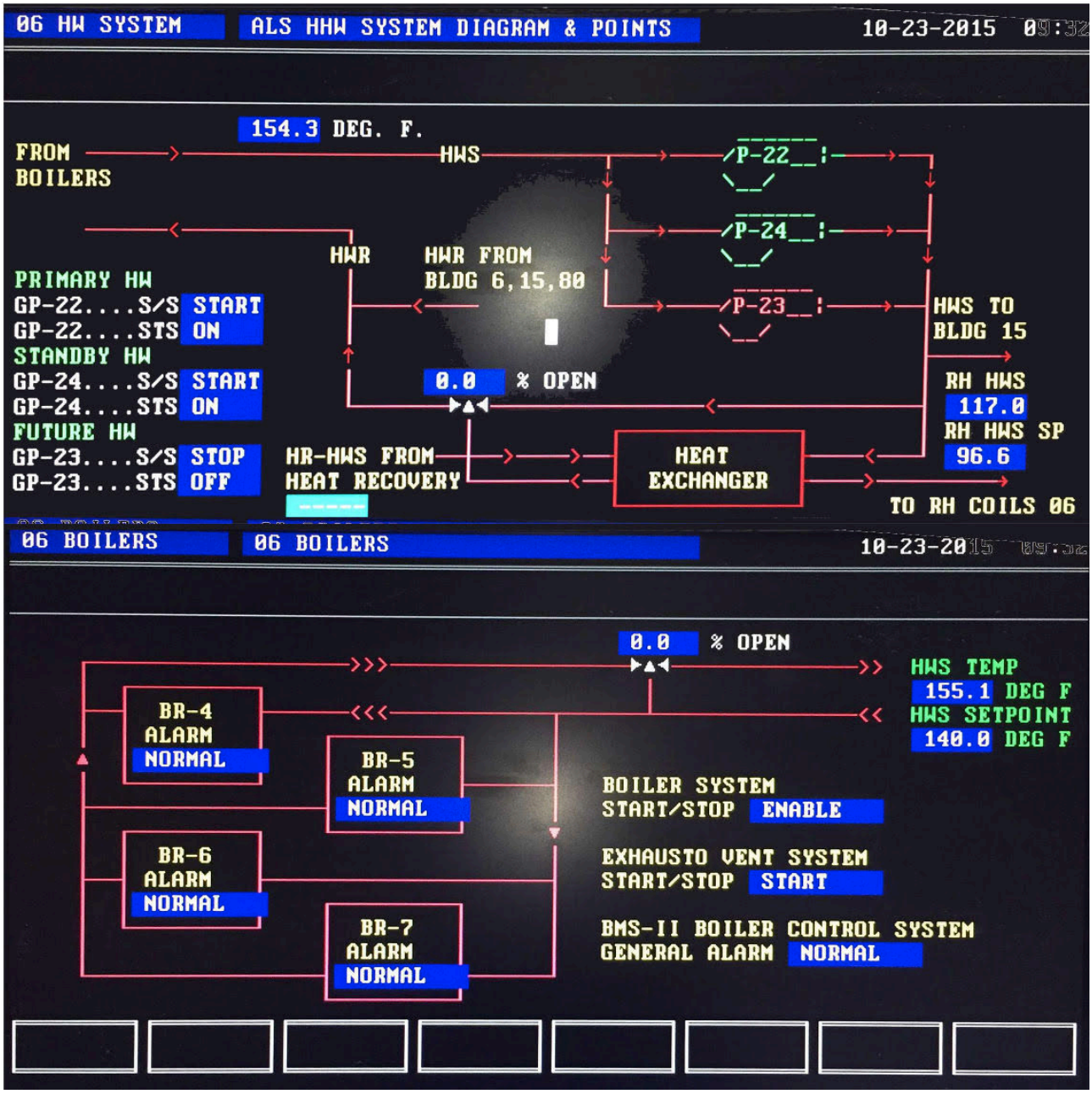
- **Building controls upgrade** from legacy Barrington and Johnson Controls systems to a more modern and powerful Automated Logic (ALC) system. Controlled systems and components included rooftop air handling units (AHUs), reheat coils and fan coil units, and the boiler system.
- **Temperature Sensors -** replacement, repositioning, recalibration of faulty units
- **Boiler system** tuning and optimization
- **Reheat valve** tuning
- **Optimization** of temperature set points and system sequences



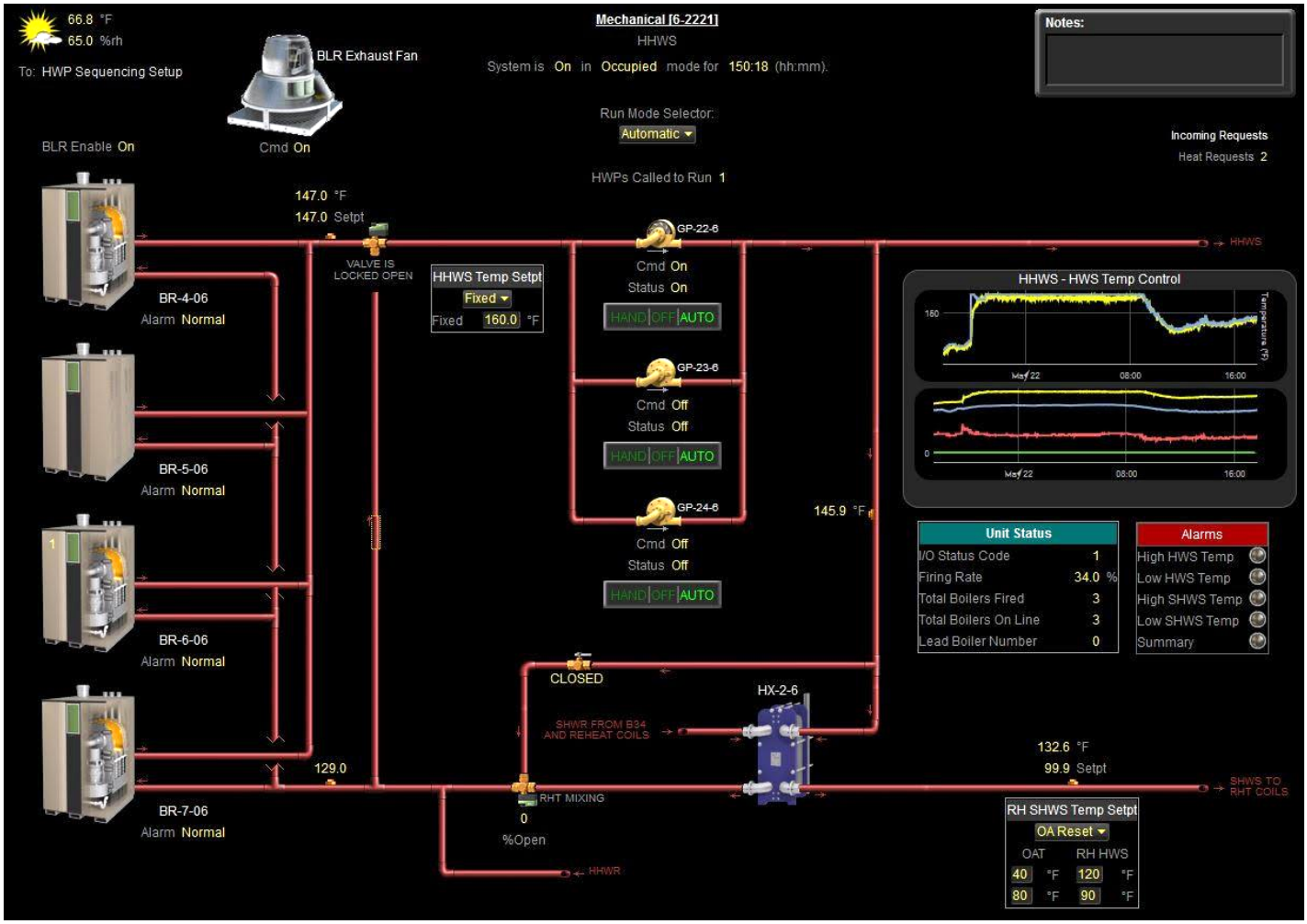
Each major upgrade in the project was followed by formal system testing and verification by kW Engineering, who served as a 3rd party Commissioning Agent.

Results

- **Reduced energy use in Building 6**:
  - 38% decrease in gas use (equates to 4.6% reduction in gas use on the Lab's main Hill campus)
  - Verified yearly savings of 202,000 kWh (electricity) and 57,000 therms (gas)
- **Reduced energy cost**: Verified annual savings of $42K vs. total project cost of $552K
- **Clean transition** to operations in order to maintain savings
- **Improved system control,** and provided a more intuitive interface for the building operator (see screenshots below)
- **Improved temperature stability** through minimizing simultaneous heating and cooling
- **Improved electrical safety** by mitigating voltage hazards
- **Facility well-positioned** for its next major upgrade, ALS-U



Before - Legacy Controls System



After - ALC System