Case Study

Design Practices for Healthcare Facility Optimization

ENGINEERING SERVICES
PROVIDED BY P2S INC.

Kaiser Permanente | Baldwin Park Medical Center

Mechanical Infrastructure Upgrades

The Kaiser Permanente Baldwin Park Medical Center offers care to over 262,000 Health Plan members residing in the San Gabriel Valley area. The hospital contains 254 beds and offers an array of health care services including primary, specialty, surgical, obstetrical and emergency services.

Originally built over 25 years ago, it was determined that the Baldwin Park Medical Center is due for infrastructure upgrades in order to keep the hospital running for decades to come. P2S is facilitating this goal by designing HVAC and plumbing upgrades to the hospital building, medical office building and central plant building.

AT A GLANCE

- **Location:** Baldwin Park, California
- **Project Size:** 560,000 SF
- **Market Sector:** Healthcare
- **Building Type:** Hospital and Medical Office Building
- **Delivery Method:** Design Assist
- **Construction Cost:** $180 million

CHALLENGES

Kaiser Permanente sets high standards for building new hospitals and maintaining their existing campuses to ensure their patients get the care they need. Having a design team prepared to take on the responsibility of overhauling the mechanical infrastructure is key to successful project completion. P2S was appointed as the designated mechanical engineering sub-consultant within the Design Assist delivery team for our proven ability to execute projects of this scope and scale.

The design-assist project delivery method entails strict coordination between all parties involved. With the added challenge of designing for a live hospital, a high degree of consideration is needed to limit interference with patient care. P2S works to balance adherence to project schedules while accommodating any necessary changes.

CLIENT OBJECTIVES

1. Lower the facility's Energy Usage Intensity (EUI)
2. Upgrade the building's mechanical infrastructure
3. Design for building longevity

ENERGY USAGE INTENSITY

A building's energy usage intensity (EUI) is determined by its energy usage per year divided by the building's square footage. Hospitals typically have higher EUI's compared to buildings of similar size. Along with square footage, factors that are correlated with a hospital's EUI include the hospital's business activities, climate, the number of full-time equivalent employees and the number of beds.

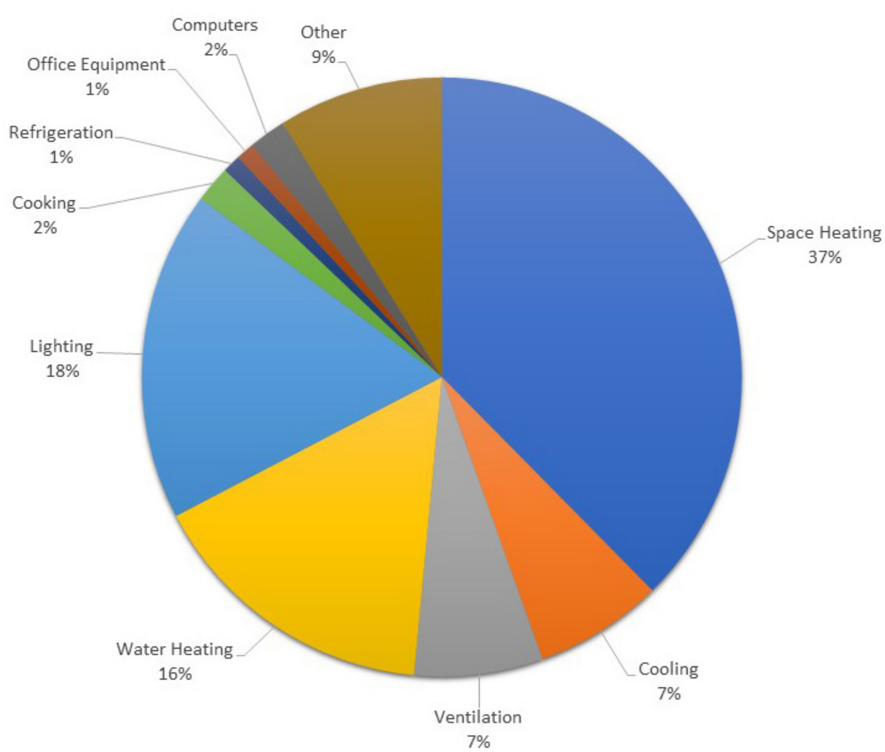
According to research conducted by the United States Energy Information Administration, fuel consumption for healthcare buildings is predominately used for space heating, lighting, water heating, ventilation and cooling. With mechanical systems playing a large role in determining a facility's energy efficiency, these mechanical infrastructure upgrades will have a big impact on the facility's EUI.

P2S designs are anticipated to help lower the building's EUI from 230 to 160.

Currently, the Kaiser Permanente Baldwin Park Medical Center operates with an EUI of 230. By replacing outdated equipment, identifying and repairing duct leakages, conducting air balance adjustments and overall improvement of the mechanical infrastructure, P2S designs are anticipated to help lower the building's EUI from 230 to 160.

From improving indoor air quality to decreasing energy consumption-related emissions, the upgrades will create a better healthcare experience for the patients and staff. A lower EUI advances Kaiser's sustainability goals and will also translate to a reduction in overhead costs.

Major Fuel Consumption (Btu) by End Use for Healthcare Buildings



Source: EIA, Table E1A. Major Fuel Consumption (Btu) by End Use for All Buildings, 2003. Sept. 2008

MECHANICAL SYSTEM UPGRADES

Heat Recovery Chiller

Hospital facilities are an optimal application for heat recovery systems because they have a constant need for hot water. The heat recovery chiller waste heat is used to provide most of the domestic hot water in the hospital for hand washing and showering. The chiller will not be piped to a cooling tower which will save energy and overall water usage.

Air-side Economizers

To further reduce Kaiser's HVAC-related energy consumption, P2S is deploying the use of air-side economizers. Implementation of this system is often referred to as free cooling. As the name suggests, these systems bring fresh air into the building during favorable outside air conditions - around 60 degrees Fahrenheit - thus eliminating or reducing the need for mechanical cooling or heating.

Air Handling System

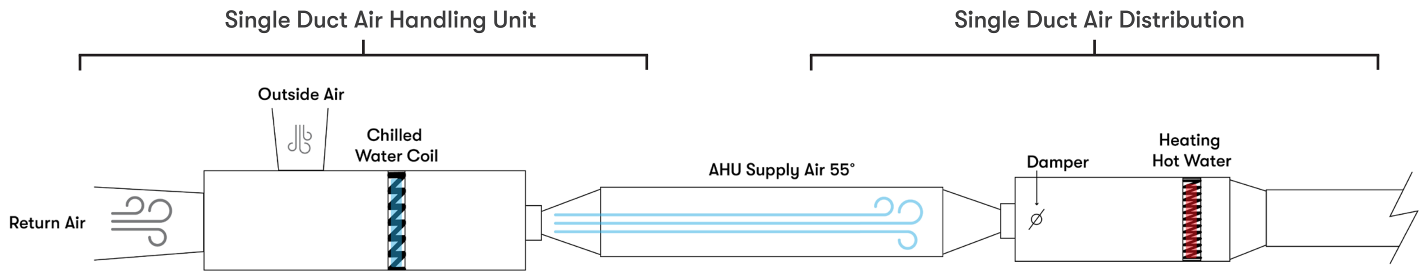
Air Handling Units (AHUs) are a vital part of building automation systems because they control temperature, humidity, pressure and air exchange. Chilled or hot water runs through coils in order to heat or cool air as needed before mixing at the zone level for precise temperature control.

Air Distribution Systems

After air flows through the air handling units, the mixing box dampers are responsible for controlling the air that heats or cools a zone. For the Kaiser Permanente Baldwin Park Medical Center, dampers are electronically controlled with a direct digital control (DDC) system which is discussed further on page 8.

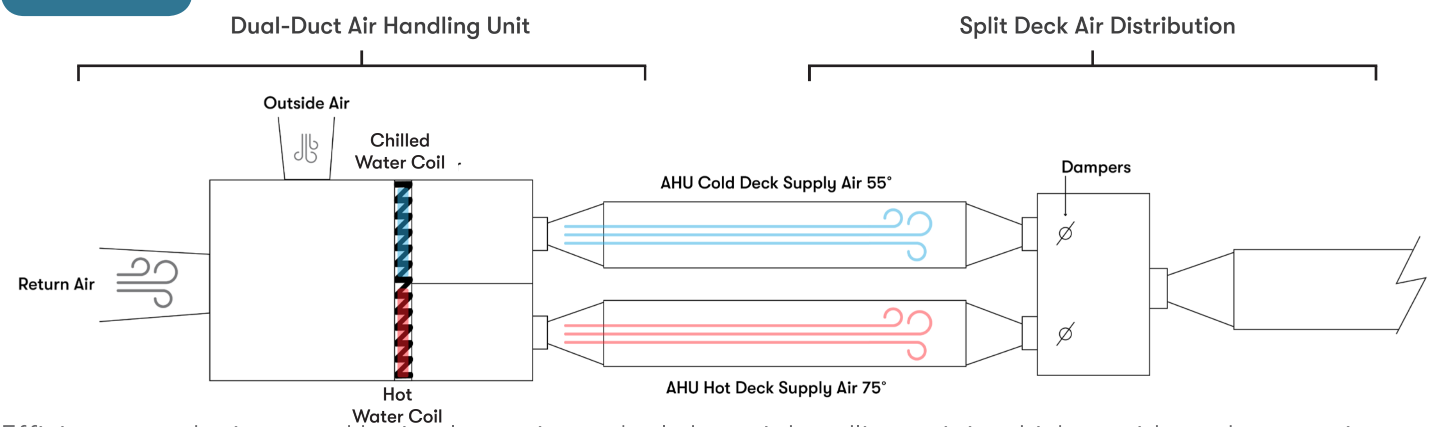
There are a variety of factors to consider when choosing an HVAC system such as the availability of space, system control and accessibility, as well as the desired heating and cooling to be supplied to each zone. We've outlined how each combination of air handling units and distribution systems work in order to determine which solution ranks supreme in a healthcare scenario.

OPTION 1



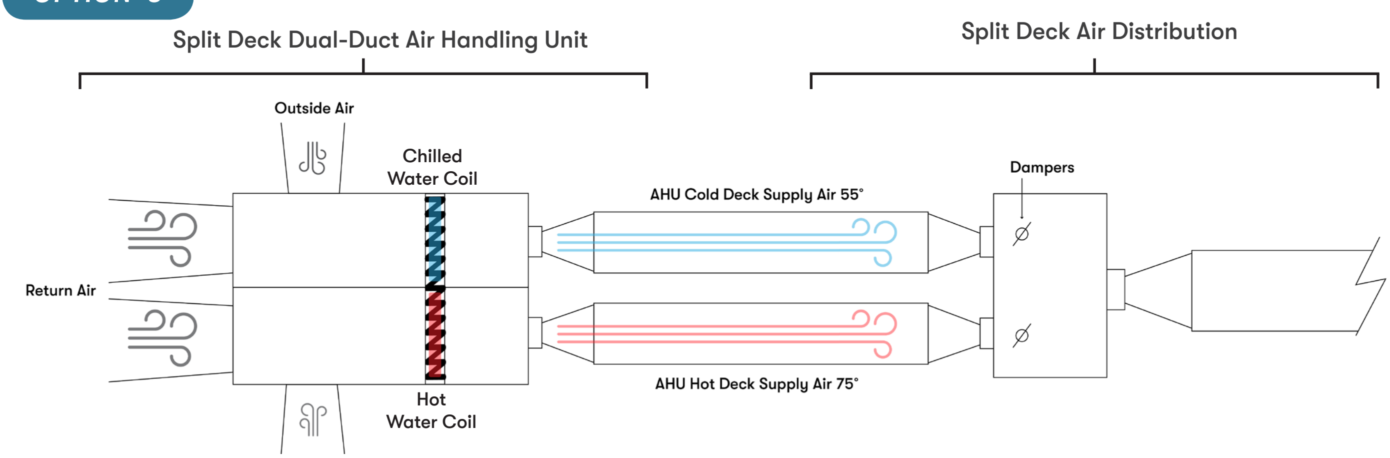
In a single duct air distribution system, space temperature is achieved by the letting cold supply air from the air handling unit pass the heating hot water coil in the air distribution system. Inefficiency is derived from the simultaneous cooling and heating that occurs. Since the supply air is kept at a constant temperature – around 55°F – the energy used to first cool the air is superseded when air must be warmed by the heating hot water coil when heating is desired.

OPTION 2



Efficiency can be improved by implementing a dual-duct air handling unit in which outside and return air is mixed, then separated into either the hot or cold deck of a split deck air distribution system. The dampers located in the split deck air distribution system's mixing box allow cold or hot air to flow into zones as needed.

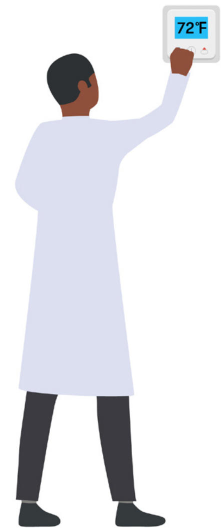
OPTION 3



Independent outside and return air flow to the hot or cold deck allow optimization of the air handing system in economizer mode. The system adapts to winter and summer conditions to maximize the free cooling or heating throughout the entire year. The building's 75°F return air is used for the hot deck supply to recycle heating energy.

MECHANICAL SYSTEM LATENCY PERIODS

Healthcare facilities are designed with patients in mind. By taking into consideration when certain rooms or departments are not in use, P2S is changing how design is approached to maximize cost-savings and efficiency.



By considering the hospital's schedule, occupancy levels and staff activities, P2S determined that shutting air flow for selected zones is an effective strategy for improving energy efficiency. For the Kaiser Permanente Baldwin Park Medical Center, shut-downs will occur after business hours so that air flow will be supplied only where it's needed. These scheduled latency periods can be achieved by implementing time clocks and occupancy sensors that are connected to the direct digital controls (DDC) system. In turn, patients and staff can be welcomed into comfortable indoor climates because the DDC will be set to turn on the HVAC system an hour before scheduled occupancy periods.

Direct Digital Controls (DDC)

Direct digital controls have become the standard for managing a building's HVAC system. They offer greater flexibility and feedback compared to the pneumatic control systems of the past. The digital interface provides connection to the building automation system (BAS) offering feedback for maintenance personnel to monitor performance and troubleshoot issues. Connection to the BAS allows for programming sequences of operations to control equipment.

Pneumatic and DDC systems both work towards the same end result - controlling the actuator that opens and closes its valves so the HVAC system can reach its desired set point.

Actuators are the interface between the control system and the mechanical system.

Pneumatic systems rely on compressed air that travels through tubes to eventually trigger a response from the actuator. These tubes must function under high pressure making them susceptible to leaks and other damage. The pressurized system is difficult to measure and the system overall requires routine maintenance to ensure proper functionality.

Digital controls on the other hand, use electrical signals to control the actuator. Compared to pneumatic systems, DDC's have faster response times giving tenants more control for increased occupancy comfort.

Kaiser Permanente Baldwin Park Medical Center will have their DDC's programmed with time clocks and occupancy sensors to accomplish their energy efficient mechanical latency periods.

VENTILATION CODE CHANGES

For building mechanical systems, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) develops guidelines to be followed within the industry. Standards are consistently reviewed by accredited design professional panelists to ensure relevancy year after year. Amendments and upgrades are made to bring clarity, accommodate for changes in building technology, and to remain applicable to the variety of building types and needs.

Healthcare facilities must follow standards set by the Office of Statewide Health Planning and Development (OSHPD). In July 2018, OSHPD adopted ASHRAE Standard 170 - Ventilation of Health Care Facilities for patient care areas. These standards were developed in partnership with Facility Guidelines Institute (FGI) and American Society of Health Care Engineering (ASHE) for comprehensive guidance on hospitals, nursing and outpatient facilities. Guidelines for healthcare facilities are more stringent due to the inherent risks involved with the potential spread of bacteria.

For non-patient areas and rooms that are not defined under the OSHPD codes, P2S is using ASHRAE 62.1 - Standards for Ventilation and Indoor Air Quality. The requirements outlined in ASHRAE 62.1 drastically reduces the amount of outside air needed to be in compliance.

THE RESULTS

Today, healthcare facilities are a venue for the community to comprehensively promote health and wellness. Kaiser Permanente's Baldwin Park Medical Center puts the image of stark and cold hospital environments in the past. The infrastructure overhaul is estimated to be complete by December 2020. Upon completion, our mechanical designs will bring automation, efficiency and controllability so patients and staff can continue to thrive.

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