The Nebraska Capitol HVAC Project

2016-2025

After two years of planning, the project to replace the 60 year old heating, ventilation, and air conditioning system in the Nebraska State Capitol is in progress. The project is replacing the existing steam and chilled water system with a closed loop ground source geothermal heating and cooling system. The project is being conducted in five phases and will require the eventual relocation of every office in the building to allow for contractor access.

HVAC History

During the Nebraska State Capitol's 1922-32 construction period, with limited space on site for a power plant, the state took advantage of the University of Nebraska's 1929 construction of a new coal fired power plant and enlarged the system to handle both facilities. The Capitol then relied on steam generated at the University's 14th and U Street power plant and sent through pipes in a tunnel under 14th street to fill radiators located throughout the building. In the 1960's, the decision was made to upgrade the Capitol's system to accommodate chilled water provided by the University's system and cool offices in summer. Most of the original radiators were replaced with induction units which pass air over heated or cooled fan coils. The 1964 units used the original one pipe supply and one pipe return system; the Capitol could be heated or cooled, but not at the same time. The temperature fluctuations of Nebraska's spring and autumn seasons mean elected officials and staff in the Capitol spend some time each year too hot or too cold. By the mid-1990's the aging pipes under 14th Street could no longer carry high pressure steam safely. A natural gas fired steam generation facility was built near the Capitol rather than replace the pipes coming from the University which continued to carry chilled water to the Capitol. The standard life of a HVAC system is 20 - 30 years. Considering the Capitol's system was approaching 60 years of use, the difficulties encountered keeping the system running, and the level of discomfort in the building, the Nebraska Legislature decided in 2014 it was time for a new system.

New System Description

The Office of the Capitol Commission hired consulting architects BVHARCHITECTURE and consulting engineers Alvine Associates to research systems and develop alternatives for the Capitol. It was determined a closed loop ground source geothermal system was the most energy efficient and cost effective over the long term. Fortunately, the State of Nebraska had just acquired a city block size surface parking lot one block from the Capitol which proved ideal for a geothermal well field. A two year planning and design phase fine-tuned the system and its installation. New fan coil units with the capability for individual office temperature control are being installed in most areas of the Capitol. Depending upon the need, the system will pull heat from or put heat into water circulating in a continuous closed loop from the Capitol to the well field. During the coldest months, the system will be backed up with steam from the state's natural gas steam plant near the Capitol.

Scope of Work

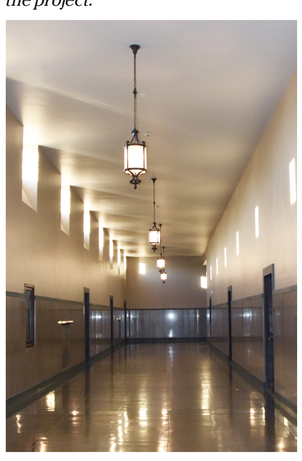
Several additional projects will accompany the HVAC work. Along with the installation of new fan coil units in offices, the original steam radiators in the Capitol at entrances, in corridors and in stairways will be reconditioned and reused. Key to the efficiency and energy savings of the project will be the repair and weather-stripping of the Capitol's windows. Because the project will require removing staff from every office in the building during the demolition and construction process, the Office of the Capitol Commission will improve the life safety system in the Capitol, installing a new fire alarm/emergency notification system and fire sprinklers where needed. A backup emergency generator will be constructed off-site in space shared with the Office of the Chief Information Officer. During well field construction, footings able to accommodate a future parking garage and office building will be installed to expand the future potential use of the well field site.

Phase II Description

During Phase I of the HVAC Project, contractor's established a presence in the Capitol's basement and organized the numerous subcontractors, the well field and piping were installed, and a backup generator was installed off-site. Inside the Capitol, in Phase II the contractors will move temporary partition walls to the Southeast quadrant and repeat the process of removing all existing HVAC equipment in the quadrant and installing the new fan coil units and refrigerant lines. Windows in the Phase II area will be repaired and fitted with weather-stripping. Corridor lamps will be removed and the first floor corridor ceilings restored to original height. Corridor lamps will be returned to their original configuration using new longer chains. The Capitol Dining Room will return to it's original location and the History Nebraska Gift Store will move to a temporary location. Phase II will upgrade systems in the Supreme Court, the State Law Library, and the East Legislative Chamber and Lounge.

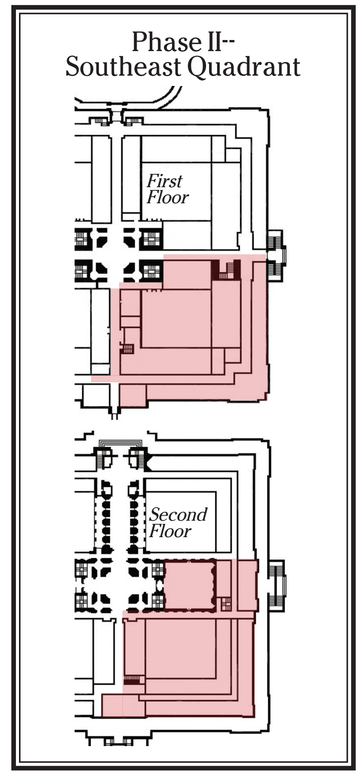
Above, the 1960's induction units were installed outside the window pockets and took up additional floor space. Below, the new units fit into the window pockets enlarging useable office space.

Above, ceilings lowered to hide air ducts added in the 1960's upgrade are being removed in the first floor corridors during the project. Below, lamps restored to their original length were re-hung in the first phase of the project. Exposed clerestory windows increase available light and return corridors to original condition. Corridor restoration will continue throughout the first four phases of the project.



Project Timeline

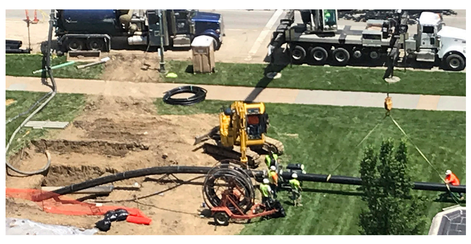
2016 - 2018	=	Schematic Design & Design Development Construction Documents Contractor Pre-qualifications Design Bidding
2016 - 2019	=	Electrical and Generator Connections
2018 - 2019	=	Well Field Investigation & Construction Phase I--Southwest Quadrant
2020 - 2021	=	Phase II--Southeast Quadrant
2021 - 2022	=	Phase III--Northwest Quadrant
2023 - 2024	=	Phase IV--Northeast Quadrant
2024 - 2025	=	Phase V--Tower

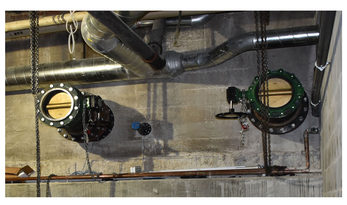


Placing the well field under a state-owned surface parking lot, photo right, saved money. Underground pipes linking the well field and the Capitol system will circulate water in a closed loop. At six hundred and seventy feet deep, the wells will keep water flowing through the system at a constant temperature of 58 degrees. It will take two hundred twenty five wells to heat and cool the Capitol. Each office will have its own temperature control, allowing staff to pull heat from or transfer heat into the circulating water as seasonal needs dictate. Staff in offices completed in Phase I are enjoying a more comfortable work environment.

Above, the well field was excavated and wells installed in two sections, north half then south.

Photo left, wells were drilled in a 20 foot grid and pipes inserted in the casings and looped to connect each well with the next. Contractors closed down a lane on K Street to allow core drilling from the Capitol to the well field on 18th Street. Once that work was completed, pipes were brought under the east lawn, photo right, and then through the outside basement wall, photo below left. Once the pipes entered the Capitol, photo below, contractors installed the pumps which will circulate the water throughout the system.





Left, a series of pumps in the basement will control the flow of water through the network of pipes depending upon the demand for heating and cooling office spaces in the system.

Left, crown molding hidden above a lowered ceiling in the south center ground floor corridor will be restored during Phase II. The molding was damaged with the installation of air conditioning ducts in the 1960's when chilled water from the University was used to cool the Capitol. An extensive network of ducts was installed to move cooled air from air handlers to spaces throughout the building. The ducts are no longer needed; the new system relies on circulating water and refrigerant, not air, for cooling. Using a removed section of the molding, right, Capitol Commission staff will make a template for the custom tools needed for the specialized plaster ceiling restoration.