



Final Project Report



Phase I Optimization Multiple Facilities

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OVERVIEW

This Final Project Report provides a summary of work performed pursuant to the Phase I Optimization project, the initial phase of the Operational and Efficiencies Improvement Program initiated in 2019 at the University of Nebraska Medical Center (UNMC) main campus. The purpose of the program is to identify buildings with opportunities for lowering operating costs by improving energy and operational efficiencies.

The first phase of the program involved optimization of mechanical systems equipment and controls at selected facilities, as well as development and integration of software for controlling and automating energy-related equipment functions and processes. Facilities involved in the first phase included:

- Lauritzen Outpatient Center & Fritch Surgery Center
- Dr. Edwin G. & Dorothy Balbach Davis Global Center
- Michael F. Sorrell Center for Health Sciences Education
- UNMC Center for Drug Discovery and Lozier Center for Pharmacy Sciences and Education

DEFINITIONS

The following definitions are offered to clarify the meaning of key, often used terms:

OPTIMIZATION

Optimization refers to the process of repairing and tuning a mechanical system's equipment, components and controls so that the mechanical systems can perform up to its maximum potential. Optimization strategies focus on achieving owner and facility specific operational requirements, while providing the optimum balance of occupant comfort, safety and energy efficiency.

The optimization process involves:

- Identification and correction of existing deficiencies in the mechanical systems' equipment and components that are preventing the systems from performing designed. This involves considerable inspection and testing of system components for operational integrity.
- Reprogramming of the system controls to implement sequences that conform with established UNMC standards and facility-specific operational strategies.

INTEGRATION (SOFTWARE AND CONTROLS)

Software and/or controls integration generally refers to the development and implementation of software API's and other tools that enable divergent building systems to communicate with each other for more unified control. Integration often provides improved and expanded functionality of existing equipment and controls. It also provides cost economies when deploying new equipment and controls, by utilizing existing components and controllers.



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PROJECT APPROACH

In accordance with efficiency objectives, each of the affected facilities was inspected and mechanical systems equipment tested for operational integrity to determine needed repairs. In addition, end users and facility staff were interviewed when appropriate to identify improvements that would enhance both energy and operational efficiencies. Solutions and budgetary estimates were developed for correcting the deficiencies and implementing improvements. While UNMC staff implemented selected repairs, Optimized Systems provided turnkey project management utilizing UNMC vendors for larger, more complex repairs. Energy consumption data from EnergyCAP was utilized to assess energy savings realized from optimization efforts. While additional cost avoidance is expected due to increased operational efficiencies, such as extended equipment life, reduced trouble calls and fewer comfort complaints, actual savings from such improvements are not quantifiable.

PROJECT OUTCOMES

SUMMARY

A variety of deficiencies were identified and corrected at each of the facilities. In addition, controls were reprogrammed to optimize the fundamental operation of the mechanical systems and implement UNMC's control standards. Various improvements affecting room scheduling and lighting control were implemented, as well.

EnergyCAP data indicates that optimization efforts resulted in a combined energy cost avoidance of approximately \$293,426 (62.3%) across all measured energy types, during the first year of optimized operations over the pre-optimized baseline year at three of the four facilities. Energy data was not available for Davis Global Center to determine energy or cost savings since it was newly occupied.

The most significant improvement in cost avoidance, expressed in total dollars, was produced at Lauritzen Outpatient Center (LOC). This was achieved in part by modifying the system to monitor conditions more closely and utilize hot water for heating rather than steam when conditions allow. Hot water, when conditions allow, offers a lower cost per Btu. Interestingly, the greatest improvement in cost avoidance as a percentage was produced at Michael Sorrell Center. While not quantifiable, additional cost avoidances are expected at all four facilities, resulting from more reliable equipment operation, extended equipment life and efficiencies due improvements made to building automation.

A summary of the efficiencies realized during the first year of optimized operations for the facilities, based on EnergyCAP data is provided below.



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TABLE

Summary of Measurable Efficiencies Achieved

Facility	Energy Consumption Reduction (KBtu / %)	Cost Avoidance Improvements (\$ / %)
Lauritzen Outpatient Center	3.7 million / 11.1%	\$107,898 / 63.3%
Davis Global Center	N/A	N/A
Michael Sorrell Center	3.7 million / 25.5%	\$63,176 / 538%
Drug Discovery Lozier Center for Pharmacy	700,781 / 4.5%	\$11,777 / 9.9%
Totals:	8.1 million / 16.4%	\$182,851 / 62.3%

LAURITZEN OUTPATIENT CENTER & FRITCH SURGERY CENTER

Optimization and integration work at Lauritzen Outpatient Center and Fritch Surgery Center was completed in July of 2020. The facility was monitored for several months thereafter to ensure the building was operating as intended. Work completed at the facility included:

- Identification and correction of 126 mechanical deficiencies
- Diagnosis and resolution of known building pressurization problems
- Optimization of five (5) air handler units (AHUs)
 - General Building AHUs, 2 each
 - Operating Room AHU, 1 each
 - Sterile Core AHU, 1 each
 - Lab AHU, 1 each
- Testing and reprogramming of 247 floor level devices for discharge temp limiting control
- Scheduling Occupied/Standby/Unoccupied room modes to meet end user requirements
- Integration of lighting with the Encelium lighting controls for improved continuity and efficiency
- Optimization of VAV boxes to minimize hot water consumption used for heating, instead of steam

As a result of the work completed, it is estimated that the facility used approximately 3.7 million KBtus less energy (11.1%), across all commodities within the first year of optimized operations, when compared with the pre-optimization baseline year. This equates approximately \$107,898 in cost avoidance, a 66.3% improvement over the baseline year.

It is worth noting that while Lauritzen’s reduction in energy consumption is similar to that of Michael Sorrell Center in total KBtus (3.7 million KBtu), Lauritzen’s cost avoidance in total dollars was significantly greater. As noted earlier, this was due to the increased use of hot water rather than steam at Lauritzen, which offers a lower Btu cost.

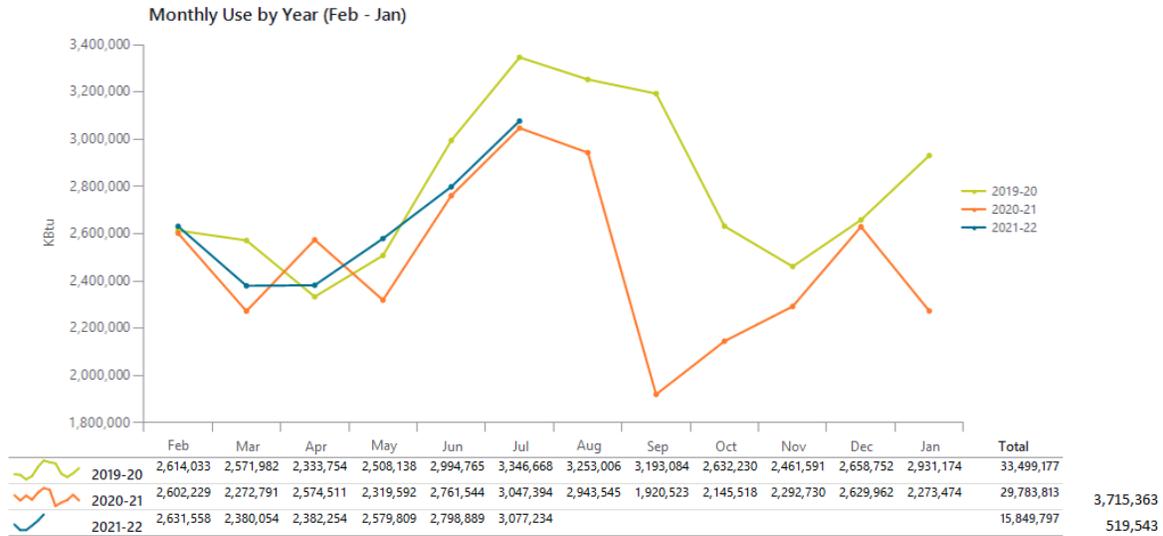


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KBtu consumption and cost avoidance data are illustrated in the following graphs.

KBTU CONSUMPTION

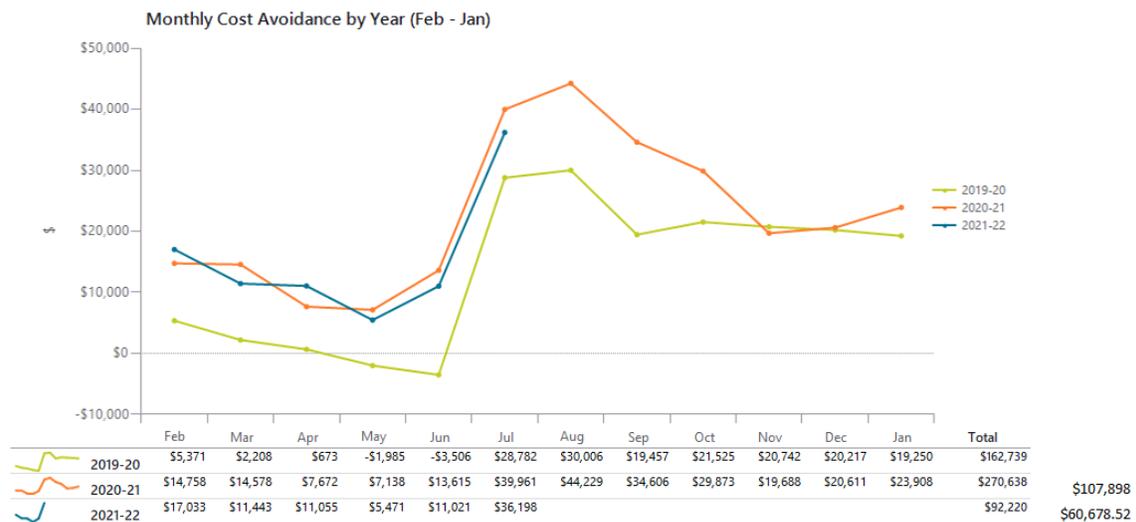
Lauritzen Outpatient Center and Fritch Surgery Center



Note: Yellow line depicts pre-optimization consumption.

COST AVOIDANCE

Lauritzen Outpatient Center and Fritch Surgery Center



Note: Yellow line depicts pre-optimization cost avoidance.



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DR. EDWIN G. & DOROTHY BALBACH DAVIS GLOBAL CENTER

Optimization and integration work at Dr. Edwin G. & Dorothy Balbach Davis Global Center was completed in August of 2020. The facility was monitored for several months thereafter to ensure the building was operating as intended. Work completed at the facility included:

- Diagnosis and resolution of known building pressurization problems
- Optimization of four (4) air handler units (AHUs)
 - General Building AHUs, 1 each
 - Chilled Beam AHU, 1 each
 - 100% Outside Air AHU, 2 each
- Scheduling Occupied/Standby/Unoccupied room modes to meet end user requirements
- Integration of lighting with the Encelium lighting controls for improved continuity and efficiency
- Optimization of VAV boxes to minimize hot water consumption used for heating, instead of steam

Whereas the Davis Global Center was a newly occupied building, there was not enough data to determine energy or cost savings, except to note that energy use is trending down in 2021, for all commodities.

MICHAEL F. SORRELL CENTER FOR HEALTH SCIENCES EDUCATION

Optimization and integration work at Michael F. Sorrell Center for Health Sciences Education was completed in September of 2020. The facility was monitored for several months thereafter to ensure the building was operating as intended. Work completed at the facility included:

- Identification and correction 140 mechanical deficiencies
- Diagnosis and resolution of known building pressurization problems
- Optimization of two (2), general building air handler units (AHUs)
- Integration of room scheduling software with EMS Room Scheduling System
- Optimization of VAV boxes to minimize hot water consumption used for heating, instead of steam

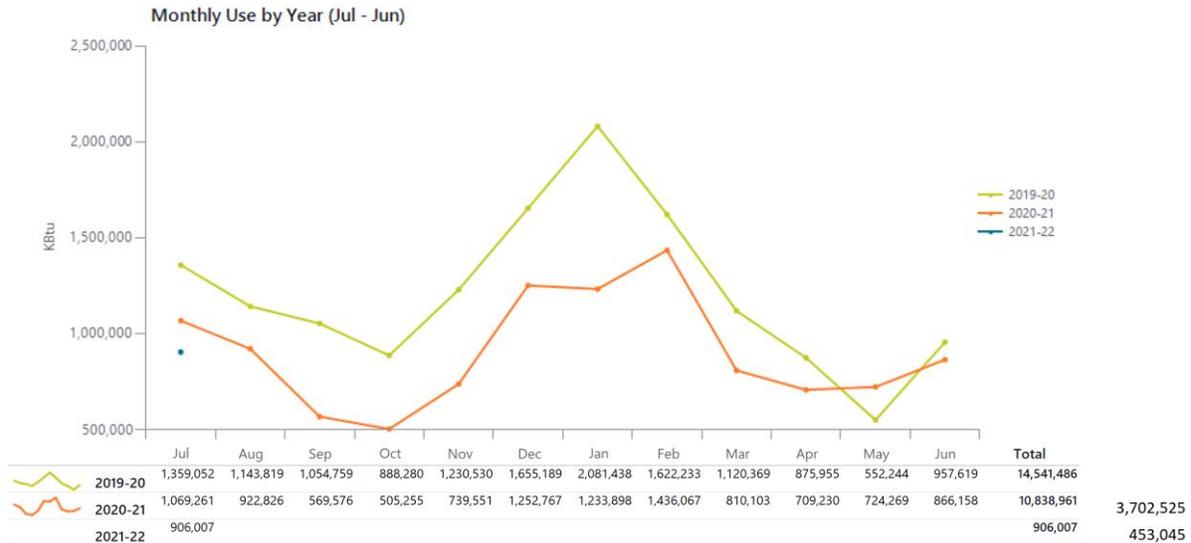
As a result of the work completed, it is estimated that the facility used approximately 3.7 million KBtus less energy (25.5%), across all commodities within the first year of optimized operations, when compared with the pre-optimization baseline year. This equates to approximately \$63,176 in cost avoidance, a 538% improvement over the baseline year.

KBtu consumption and cost avoidance data are illustrated in the following graphs.



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KBTU CONSUMPTION Michael Sorrell Center



Note: Yellow line depicts pre-optimization consumption.

COST AVOIDANCE Michael Sorrell Center



Note: Yellow line depicts pre-optimization cost avoidance.



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UNMC CENTER FOR DRUG DISCOVERY AND LOZIER CENTER FOR PHARMACY SCIENCES AND EDUCATION

Optimization and integration work at UNMC Center for Drug Discovery and Lozier Center for Pharmacy Sciences and Education was completed in August of 2020. The facility was monitored for several months thereafter to ensure the building was operating as intended. Work completed at the facility included:

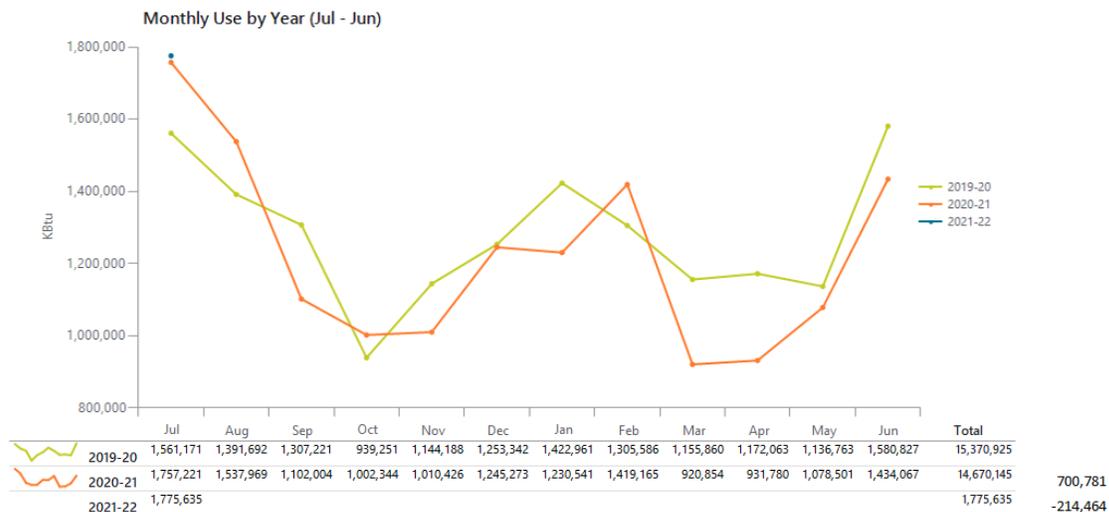
- Optimization of VAV operating sequences
- Diagnosis and resolution of known building pressurization problems
- Optimization of two (2) air handler units (AHUs)
 - General building AHU, 1 each
 - 100% outside air AHU, 1 each
- Testing and reprogramming of 83 floor-level devices for discharge temperature limiting control
- Scheduling Occupied/Standby/Unoccupied room modes to meet end user requirements
- Integration of lighting with the Encelium lighting controls for improved continuity and efficiency
- Optimization of VAV boxes to minimize hot water consumption used for heating, instead of steam

As a result of the work completed, it is estimated that the facility used approximately 700,781KBtus less energy (4.5%), across all commodities within the first year of optimized operations, when compared with the baseline year (pre-optimization). This equates to approximately \$11,777 in cost avoidance, a 9.9% improvement over the baseline year.

KBtu consumption and cost avoidance data are illustrated in the following graphs.

KBTU CONSUMPTION

Center for Drug Discovery | Lozier Center for Pharmacy



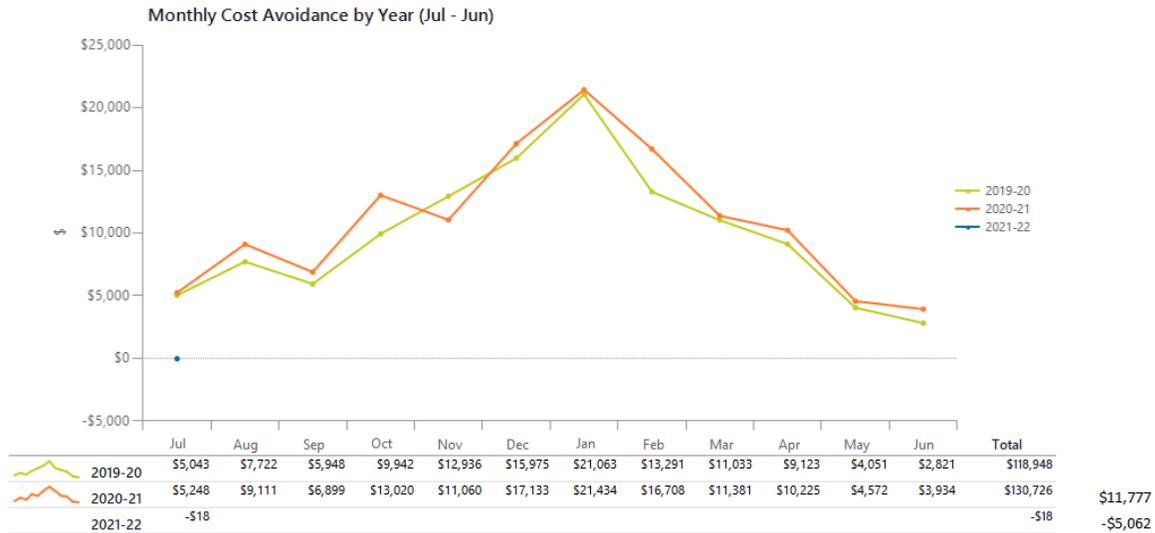
Note: Yellow line depicts pre-optimization consumption.



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COST AVOIDANCE

Center for Drug Discovery | Lozier Center for Pharmacy



Note: Yellow line depicts pre-optimization cost avoidance.

RECOMMENDATIONS

Optimized Systems recommends follow-up assessments in Spring 2023 to ensure efficiencies are being sustained. Additional studies to demonstrate energy conservation and cost avoidance achievements would be desirable, especially at Davis Global Center.

CLOSING

It has been our pleasure working with Nebraska Medicine on these projects. We are confident that the results of these projects will significantly improve the operational efficiency of your facilities and we hope you have found our involvement to be helpful and informative. If you would like to review any of the information in this report or discuss any aspects of the project, please do not hesitate to contact me.

Respectfully submitted,

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