Kent McCanner Elementary School Building

101 Clarke Pl,
Frederick, MD 21701

Energy Survey Analysis Report

Prepared for:
Maryland Department of General Services (DGS)

Department of General Services

Prepared by:
UMD Smart and Small Thermal Systems (S2TS)
Principal Investigator: Dr. Michael Ohadi
Co-directed by Dr. Amir Shooshtari

October 13, 2021

* FOR DGS and/or their assignee purposes only. No 3rd party circulation is allowed. Questions should be directed to the DGS contact person. UMD technical contact person is Dr. Michael Ohadi (ohadi@umd.edu)

Building Description

The Kent McCanner elementary school building is located at 101 Clarke Place, Frederick, MD, 21701. This building is one of the sixteen buildings in the Maryland School for the Deaf Frederick Campus. The building was constructed in 2009 and is a one-story building with an overall floor area of 78,200 square feet, as specified by the facility manager. Fig. 1 shows an overview of the building.

Fig. 1: Kent McCanner Elementary School Building

The elementary school building is otherwise a typical elementary school that houses primarily office spaces, classrooms spaces, a cafeteria, and a gym. The building also consists of several other miscellaneous spaces, such as mechanical rooms and electrical rooms. The building has a mezzanine level that houses all of the nine air handling units (AHUs) for the building. The mechanical room located in the basement of the elementary school building houses one chiller, two boilers, and one cooling tower. All of these units work to serve and provide the HVAC needs of the entire building.

The facility exemplifies a typical elementary school in function. The entire building is operating on a 7:00am to 6:00pm building occupancy schedule on weekdays (Monday to Friday) throughout the year. Likewise, the building HVAC systems operate during all these hours, and they are off during unoccupied hours. The building is mostly unoccupied during the summer months because the students are on summer recess during this time. However, the existing mechanical drawing suggests that the HVAC system is still operating in full load during the day in the summertime.

EEM 1 - Revisit HVAC Controls and Schedules

- Ensure that the building's existing HVAC system is not operating in full load for unoccupied spaces.

The utility data showed that electricity consumption is relatively high in the summer compared to the predicted values, which indicates that an unnecessary amount of electricity may be being consumed during the summer. The trend for electricity consumption throughout the year should actually be more of a flatter trend throughout the year as students are away for vacation during the summertime. The high electricity consumption in the summer is suspected to result from the HVAC system running at full load, even when spaces are unoccupied during the day in the summer. Generally, spaces are not used during unoccupied hours, so there is no need to cool the space in full load during these times. Therefore, energy consumption should decrease when the building's HVAC systems are not serving the unoccupied spaces in full load. The desired controls systems and system scheduling may need to be revisited in its entirety so that cooling is supplied through the air terminal units for unoccupied spaces at a minimum value as specified in the mechanical drawings during the day in the summer. The contractor shall examine the existing sequence of operations regarding the HVAC systems, including but not limited to the chillers, boilers, air handling units, and air terminal units. They shall also ensure that the controls and scheduling of the existing HVAC systems are set so that they provide minimum cooling during the day in the summer to spaces when they are unoccupied. As shown in the energy audit report modeling data, it has been estimated that this could result in ~14% savings in overall electricity consumption.

EEM 2 - Lighting Upgrades

- Replace all fluorescent lights in the building with new LED bulbs
- Provide lighting controls for daylight harvesting and dimming.

The building mostly employs fluorescent lighting, and most of the building is served by T8's. Currently, there are already functional occupancy sensors for about 85% of the spaces in the building. Upgrading the light fixtures to LED has multiple end-user benefits. Compared to fluorescent lighting, LED lighting can yield significant energy savings while also reducing the maintenance and labor costs associated with fluorescent lighting. LED light fixtures also have longer rated lifespans which would mean fewer costs associated with replacing them. Improved lighting controls, such as daylight harvesting and dimming, further enhance the energy-saving potential of LED lighting. Therefore, all fluorescent light bulbs in the building shall be replaced with energy efficient LED light bulbs to match the existing bulb size/type and fixture styles. The new LED lights bulbs shall then be integrated to the existing occupancy controls and sensors for all spaces which are applicable. Additionally, upgraded lighting controls to include daylight harvesting and dimming shall be provided. As mentioned in the energy audit report, transitioning towards LED lighting along with upgraded controls could yield electricity savings of around 50% of total annual lighting consumption. According to the modeling data, these lighting upgrades are estimated to result in 3.9% savings in overall electricity consumption. The lighting disposal and replacements as well as the lighting controls shall be DLC or Energy Star certified and comply with the Maryland Green Purchasing Committee Approved Specification according to the documents below.

- https://dgs.maryland.gov/Pages/GreenPurchasing/Resources/Lighting.aspx
- https://dgs.maryland.gov/Documents/GreenPurchasing/Specs/LightingProductsSpecification.pdf

List of additional recommendations

Energy Star Certified Appliances

There are currently several different appliances being used throughout the building, including but not limited to microwaves, refrigerators, freezers, ice makers, and dishwashers for small kitchens as well as washers and dryers for the gymnasium and other spaces. These appliances can be high energy consumers depending on their energy ratings and age. Replacing all appliances that are more than five years old and are also not Energy Star certified with new ones that are Energy Star certified will result in savings in electricity consumption, and savings may be shown in water consumption as well. The contractor shall locate all applicable appliances within the building and after careful and professional assessment provide replacement options with pricing to include installation costs and estimated payback periods. For appliances where the Energy Star rating is unknown, replace these as necessary with products with energy efficiency ratings that are in the top 25% in their respective markets.

Dehumidifiers and Air Purifiers in Non-Occupied Spaces

It was observed that there were a few standalone dehumidifiers and several air purifiers constantly running in the classroom spaces that were not occupied, even though students were on summer vacation. These units seemed to be running in order to solve humidity issues with the associated spaces as well as to mitigate the spread of viruses. The contractor should check if there is a humidity issue in the building and seek a proper solution. Although the energy consumption of a single unit may not be significant compared to the energy consumption of the building's central HVAC system, having several of these units constantly running throughout the day and night may cause unnecessary energy consumption to accumulate throughout the year to a point where it is a noticeable consumption. Also, if humidity remains an issue, the contractor shall investigate the air handling units associated with the VAV boxes serving the humid spaces and ensure that the air handling units of concern are functioning properly according to their original mechanical design as specified in the mechanical schedule. The contractor shall then remove the stand alone dehumidifiers once dehumidification is properly achieved at the system level. With regards to the air purifiers, to save energy and as a sustainable solution, these air purifiers shall be removed and HEPA filters shall be installed in the VAV boxes serving these spaces as an alternative solution to the air purifiers.

The Green Wall

Green walls can be considered for one or more lobby areas of the facility to further condition the air in the space. The choice of lobby area(s) shall be coordinated with the owner. A drip free indoor living wall option (for water containment) can be considered in the lobby. Green/living walls contribute to indoor air quality. They naturally provide oxygen, humidity, and reduce particulates and volatile organic compounds.

Additionally, studies have indicated plants enable more productivity among the building occupants while also ensuring the comfort levels. Indoor living wall solutions provided by LiveWall could be considered for the lobby space as the basis of design.

Smart Power Strips

Smart power strips can reduce energy waste, prolong life of electronics, and offer premium fireproof surge protection. It will be advantageous from an energy audit standpoint to replace all power strips in the building with smart power strips in order to reduce annual electricity consumption. All power strips in the building shall be replaced with smart power strips, equal to ones provided by Tricklestar or similar brands. The contractor shall provide pricing for provision of smart power strips as well as for their installation in accordance with existing power connection setups for each room in the building.

Summary Scope of Work

System Description	Current System/Issue	Proposed System/Solution	Comments
HVAC Controls and Schedules	Spaces are potentially overcooling during unoccupied hours.	Examine existing HVAC sequence of operations to ensure that VAV boxes provide minimum cooling load during unoccupied hours in the summer.	This will result in year-round savings, without compromise on the necessary comfort requirements. Expected electricity savings are ~14%.
Lighting Throughout the Entire Building	Fluorescent.	LED lighting along with controls for daylight harvesting and dimming.	LED lighting and controls can yield around 50% savings in lighting consumption. Expected electricity savings are ~4%.
Non-HVAC Related Appliances	Some are old and not Energy Star certified.	Replace more than 5-yr-old appliances that are not Energy Star certified with new Energy Star certified ones.	Energy Star certified appliances can result in 10 to 25 percent of electricity savings compared to non-Energy Star certified appliances [1].
Dehumidifiers	Constantly running	Remove air purifiers and	An average room air

and Air Purifiers	even when spaces are unoccupied.	install HEPA filters in VAV boxes serving associated spaces. Investigate AHUs associated with VAV boxes serving humid spaces and ensure AHUs are functioning according to the original mechanical design. Once dehumidification is properly achieved at the system level, remove standalone dehumidifiers.	purifier consumes around 18 kWh per month when operating for 12 hours each day [2].
Green Wall	No Green Wall.	Install Green Wall.	This will improve indoor air quality.
Power Strips	Standard Power Strips.	Smart Power Strips.	The payback period of a smart power strip is around 1.1 years [3].

References

[1] https://www.bgesmartenergy.com/residential/rebates-and-discounts/Benefits-ENERGY-STAR-Appliances

[2] https://reviewsofairpurifiers.com/air-purifier-electricity-consumption-calculator/

[3] https://www.verde.expert/are-smart-power-strips-worth-the-money/