

Baltimore City Public Schools' Air-Conditioning Plan: Update

While approximately 60 of Baltimore's public school buildings lack air-conditioning, this is only one area of concern with respect to City Schools' buildings portfolio. The district's buildings overall are the oldest of any school district in the state, and numerous buildings need significant system upgrades or complete replacement. City Schools does not have sufficient funds to address these needs or even to perform necessary basic and preventative maintenance with the frequency recommended under industry standards, including to critical mechanical, plumbing, electrical, and security systems. It is also the case that heating is a bigger concern than air-conditioning, with students losing more days of instruction due to lack of adequate, reliable heating than to lack of cooling.

In response to concerns raised in December 2016 by Governor Larry Hogan and Comptroller Peter Franchot and subsequent withholding of \$5 million in funding because of the lack of air-conditioning, City Schools developed a plan in January 2017 to ensure that all buildings would be air-conditioned by the 2022-23 school year. That plan proposed installing window units and split systems at an estimated cost of \$29.7 million plus costs for necessary electrical upgrades and other steps related to installation to ensure safe, healthy operation of the units. (See the appendix for an overview of the January 2017 plan.)

As the district proceeded to plan implementation of the original January 2017 plan for window units, it determined that installing vertical package units (VPUs) is the better approach, as outlined in the rationale provided on subsequent pages of this report. The plan for VPUs has been reviewed by the district's ad hoc facilities advisory group, consisting of professionals from leading construction and development firms brought together by City Schools CEO Sonja Santelises to advise and make recommendations based on their expert knowledge of industry best practices. The advisory group agrees that in the absence of sufficient funds to install complete central HVAC systems in all buildings, VPUs are not only the better approach but ultimately the more cost effective.

At the time of development of the original January 2017 plan, full costs associated with electrical upgrades were unknown. As plan implementation has proceeded, the extensive scope of those required upgrades due to the age and poor condition of the district's buildings has now been established, with bids for electrical work averaging \$20,000 to \$30,000 per classroom. These costs raise the overall expense of the project to such an extent that completion by 2022-23 is no longer possible given available funds. It is important to note that these added costs and delay would occur regardless of whether VPUs or window units were installed, as the electrical upgrades would be necessary with either approach.

The date for completion of the revised plan is subject to availability of resources, with costs to be included among the district's extensive list of priorities included in annual requests for Capital Improvement Program (CIP) funds.

Rationale

- **VPU provide both heating and cooling.**
City Schools students lose more days of instruction due to lack of adequate, reliable heating than to lack of air-conditioning. Unlike window units, VPUs provide heat as well as cooling.
- **VPU have longer life spans than window units, and are therefore more cost efficient.**
VPUs are designed for nonresidential use in settings such as classrooms, whereas window units are designed to cool smaller rooms in residential settings. In those settings, window units may have life spans of 10 or more years; however, when they are installed in large rooms routinely occupied by 30 or more people, that life span declines to an estimated one or two years, meaning that frequent replacement of window units must be factored into overall cost estimates. VPUs, built for classroom-sized rooms, have a lifespan of 25 or more years.
- **VPU are more energy efficient than window units.**
The U.S. Department of Energy has ruled that VPUs have an energy efficiency ratio (EER) rating of 10 or above. Window units typically have lower EER ratings.
- **Unlike window units, VPUs meet building codes to which City Schools must adhere.**
Unlike widespread reliance on window units, installation of VPUs would enable City Schools to adhere to the following (as initially adopted, with modifications, by Ordinance 15-547, effective December 1, 2015):
 - Maryland Building Performance Standards (January 2015)
 - International Building Code (2015)
 - National Electrical Code (2014)
 - International Fuel Gas Code (2015)
 - International Mechanical Code (2015)
 - International Plumbing Code (2015)
 - International Property Maintenance Code (2015)
 - International Fire Code (2015)
 - International Energy Conservation Code (2015)
 - International Green Construction Code (2012)
- **Unlike window units, VPUs meet American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards.**
The International Building Code (which includes the International Mechanical Code for mechanical systems) references ASHRAE as the applicable standard to follow. ASHRAE does not allow for window units because they do not provide the ventilation and fresh-air intake required for classrooms.
- **Over the long term, VPUs will be more cost effective.**
Considering that they address both heating and cooling, are more energy efficient, and have a longer life span, VPUs will ultimately be more cost effective than window units because of lower maintenance, energy, and replacement costs. The Interagency Commission on Public School Construction requires a full life cycle cost analysis to verify the most appropriate system type, including initial, operating, replacement, and maintenance costs.

Cost estimate

Based on bids for systems being installed in the current school year (2018-19), VPUs will cost approximately \$40,000 to \$50,000 per classroom (1,500 square feet or less), including

- Design
- Electrical upgrades (may include underground electrical duct banks, new transformers, new subpanels, etc.)
- Vertical package unit (including security grille)
- Louver installation

The VPUs themselves cost approximately \$20,000 per unit. In the bids received to date for VPUs to be installed in the current school year, most of the remaining \$20,000 to \$30,000 per-classroom cost results from the need for electrical construction and upgrades due to the age and poor condition of the district's buildings. As previously noted, these upgrades would be required regardless of whether VPUs or window air-conditioning units were installed. Note that cost estimates in both the 2017 plan and this updated plan do not include demolition or abatement of hazardous material, which is often encountered in Baltimore's school buildings.

At the request of a member of the district's facilities advisory group, a third-party private construction company reviewed the bids for the first five schools to receive VPUs, and their estimates for these projects were within 10% (1 point) of the bids received.

The total estimated cost of the updated plan to install VPUs is as follows:

$$\begin{aligned} & [\$20,000 \text{ per unit} + \$20,000 \text{ to } \$30,000 \text{ for electrical upgrades}] \\ & \quad \times 1,353 \text{ classrooms}^* \\ & = \$54,120,000 \text{ to } \$67,650,000 \end{aligned}$$

Based on estimates now available for electrical upgrades, the cost of completing the original plan to install window units would be as follows:

$$\begin{aligned} & [\$9,700 \text{ per unit} + \$20,000 \text{ to } \$30,000 \text{ for electrical upgrades}] \\ & \quad \times 1,353 \text{ classrooms}^* \\ & = \$40,184,100 \text{ to } \$53,714,100 \text{ minimum}^{**} \end{aligned}$$

* *The number of classrooms requiring air-conditioning has decreased from the 1,698 noted in the original plan because some HVAC projects have been completed, some buildings have been surplus, and some have been renovated or replaced through the 21st Century School Buildings Program. For the same reasons, the number of buildings to be addressed under the revised plan has dropped from 76 to 60.*

** *This range is a minimum, as larger classrooms would require installation of two units.*

While costs for the revised plan are higher than those of the original plan, the additional expense is both appropriate and necessary. The district cannot install units that do not meet applicable building codes and are not energy efficient. Further, over a 25-year period, the added cost of frequent replacement of window units would result in a total project cost exceeding that for installation of VPUs.

Plan implementation

VPU's will be installed in the following three schools no later than June 30, 2019, with approximately \$4.2 million in state and local funding.

School	No. of classrooms	Estimated cost
Lakewood Elementary School #86	9	\$464,200
Northern building #402 (Reginald F. Lewis High School #419)	22	\$1,114,300
Mergenthaler Vocational-Technical High School #410	84	\$2,661,396
Totals	141	\$4,236,896

VPU's will be installed in the following additional three schools by December 31, 2019, with approximately \$8.6 million in state and local funding. (Note that schedule delays at these schools have been beyond the control of City Schools, including historic requirements and bid protests.)

School	No. of classrooms	Estimated cost
Baltimore Polytechnic Institute #403	49	\$2,549,470
Western High School #407	42	\$2,085,930
Frederick Douglass High School #450	72	\$3,960,000
Totals	163	\$8,595,400

VPU's will be installed in the following ten schools (in six buildings) for \$14 million, with completion dates as noted. Because these are under-utilized buildings (< 60% full), City Schools receives no state funding for capital projects at these schools and will therefore use general funds.

School	No. of classrooms	Estimated cost	Estimated completion
Northern building #402 (Achievement Academy #413, Success Academy #855)	26	\$1,267,250	Sept. 2019
Edmondson-Westside High School #400	31	\$1,791,300	Dec. 2019
Booker T. Washington building #130 (Booker T. Washington Middle School #130, Renaissance Academy #433)	50	\$2,854,260	June 2021
Southside building #181 (New Era Academy #422)	23	\$1,309,840	June 2021
Harlem Park building #78 (Augusta Fells Savage Institute #430, Bluford Drew Jemison STEM Academy #364)	56	\$3,254,213	June 2021
Thurgood Marshall building #170 (currently houses Furley Elementary School #206, Vanguard Collegiate Middle School #374)	95	\$3,523,137	June 2022
Totals	281	\$14,000,000	

The below schools are scheduled for air-conditioning pending construction bids and, for the CIP projects, availability of funding allocations. (Note that the CIP project for Gilmore Elementary School has been canceled due to the Board of School Commissioners' decision to close the school effective June 2019.)

- *CIP projects*

School	Estimated Cost	Status
Baltimore City College #480	\$3,630,000	
Belmont Elementary School #217	\$1,320,000	in design
City Springs Elementary/Middle School #8	\$1,650,000	
Collington Square Elementary/Middle School #97	\$1,705,000	
Curtis Bay Elementary/Middle School #207	\$1,595,000	
Dickey Hill Elementary/Middle School #201	\$1,980,000	in design
Diggs Johnson building #162 (Southwest Baltimore Charter School #328)	\$1,870,000	in design
Dunbar MS building #133 (National Academy Foundation #421)	\$3,355,000	
Edgecombe Circle Elementary School #62	\$2,200,000	in design
Edgewood Elementary School #167	\$1,430,000	in design
Eutaw-Marshburn Elementary School #11	\$1,705,000	
Franklin Square Elementary/Middle School #95	\$1,595,000	
Graceland Park/O'Donnell Heights Elementary/Middle School #240	new building with central HVAC in construction	
Harlem Park Elementary/Middle School #35	\$1,265,000	
Hazelwood Elementary/Middle School #210	\$1,595,000	In contract award stage to start construction
Hilton Elementary School #21	\$1,485,000	In contract award stage to start construction
The Historic Samuel Coleridge-Taylor Elementary School #122		In contract award stage to start construction
Holabird Elementary/Middle School #229	new building with central HVAC in construction	
Johnston Square Elementary School #16	\$2,420,000	

Matthew A. Henson Elementary School #29	\$1,650,000	In contract award stage to start construction
Mount Royal Elementary/Middle School #66	\$2,310,000	in design
Thomas Hayes building #102 (houses National Academy Foundation #421)	\$1,650,000	
Thomas Jefferson Elementary/Middle School #232	\$1,595,000	In contract award stage to start construction
William S. Baer School #301		Out for bid
Windsor Hills Elementary/Middle School #87	\$1,155,000	in design
Yorkwood Elementary School #219	\$1,375,000	

- *21st Century School Buildings Program*

The following schools will receive central HVAC systems as part of their renovation or replacement under the 21st-century program.

- Arlington Elementary School #234
- Calverton Elementary/Middle School #75
- Claremont School #307
- Cross Country Elementary/Middle School #247
- Govans Elementary School #213
- Lois T. Murray Elementary/Middle School #313
- Mary E. Rodman Elementary School #204
- Medfield Heights Elementary School #249
- Montebello Elementary/Middle School #44
- Northwood Elementary School #242
- Patterson High School #405
- Sharp-Leadenhall Elementary School #314

Appendix

Overview of January 2017 Air-Conditioning Plan

- City Schools had a total of 76 buildings without air-conditioning at the time of the original plan development [i.e., January 2017]. By the end of 2017, the district anticipated this number would drop to 66 buildings based on the following factors:
 - Buildings in construction with air-conditioning being installed
 - Buildings being surplus to the city as part of the 21st Century School Buildings Program
 - Buildings under construction as part of the 21st-century program and not currently housing students
- As of January 2017, plans were in place to air-condition an additional 18 facilities as part of the 21st-century program, as projects with approved funding for HVAC systems, or through pending closure.
- The cost to provide air-conditioning in the remaining 48 buildings through use of portable window units (1,698 classrooms and total of 2,450 window units needed) was estimated at \$29 million, based on a per-unit cost provided by the Department of General Services of \$9,700 each, including design, minor utility upgrades, ventilation, and installation. The Department of General Services noted that full costs for utility upgrades were a significant unknown, with variation expected from school to school.
- The January 2017 plan noted that the district was considering the inclusion of split systems instead of solely portable window units, at a cost of \$25,000 per classroom.
- The use of split systems would raise the total plan cost to \$29.7 million, based on the following assumptions:
 - Portable window units for 14 buildings housing middle/high and high schools
 - Split air-conditioning systems for 24 buildings housing elementary and elementary/middle schools
 - No air-conditioning installation in 10 schools that are being used as temporary locations for school programs whose buildings are in construction (“swing space”)
- Cost estimates were noted as subject to change based on scope of projects, facility condition, power upgrade needs, asbestos abatement, and contingency.
- The plan was noted to have considerable trade-offs in terms of deferring other critical projects including those related to fire safety, heating, elevator, roof, and window projects.