Not Too Cool for School: Demystifying Costs and Accelerating Pathways for All-Electric Schools

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ABSTRACT

Schools represent a critical area for accelerating efficient buildings and reducing operational greenhouse gases through electrification. Electrification of gas equipment in schools is not only key to achieving climate goals, but also an opportunity to address deferred maintenance, indoor air quality, and occupant comfort. The urgency of these projects is driven by wildfire smoke, heat waves, and airborne diseases. However, schools are often severely limited by capital budgets. Therefore, understanding the cost ranges and scope implications of electrification upgrades is crucial to be able to incorporate into project plans, budgets, and possible school bonds. Building lifecycle events can present convergent project opportunities, like improving air filtration alongside planned HVAC upgrades. Conversely, electrification can trigger additional costs, like wiring and panel upgrades.

This study evaluates school electrification technologies by reporting on installation costs as well as energy impacts, design difficulty, and potential technology gaps. Four lifecycle events are analyzed as potential electrification opportunities: Emergency replacement, planned upgrades and maintenance, deep retrofits, and facility additions. By building on these concepts for primary, secondary, and modular school buildings, the paper further helps readers leverage development opportunities and cost data to creatively "stack[1]" federal, state, local and other funding mechanisms. Additional context is provided regarding the barriers and opportunities for success in implementation of electrification projects, which can be coupled with the costs and equipment feasibility analysis previously reported in the BETR analysis. The paper also helps decision makers determine the specific steps and measures required for electrification and informs government agencies and utilities of the costs and effort required to decarbonize schools. Lastly, this paper provides key information to empower policy makers to craft well-informed policies to accelerate strategic decarbonization in schools.

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[1] "Stacking" funding refers to the practice of combining multiple sources of funding to support a project.

Introduction

Schools are an important place to address climate adaptation, indoor air quality, and utility costs. But school district portfolios and stakeholders are complicated, they suffer from historic injustices, and operations and maintenance of buildings is significantly underfunded. As a result, school infrastructure is crumbling, earning just a D+ grade on a national list (ASCE 2021). Schools in formerly redlined communities are further burdened because the lack of investment in these communities serves as a structural inequity which limits the amount of bond funding available to support school infrastructure. (Vincent 2015)

Currently, over 140 jurisdictions in the United States have zero emissions ordinances for buildings and transportation (BDC 2024). In order to comply with these ambitious community goals, school buildings and fleets must be prepared to be all-electric and served by renewable energy. A recent report on energy justice and net zero in Illinois suggests that "near-term actions are needed to spur adoption of electrification technologies and to accelerate the transition towards decarbonization" (Mahone 2020). In addition, many schools now must address the realities of wildfires and more extreme temperatures to remain operational through those events (PBS 2023). Schools are also constantly grappling with critical systems that are aging and failing: the U.S. Government Accountability Office reported that approximately one third of schools need to update or replace heating, ventilation, and air conditioning (HVAC) equipment (USGAO 2020).

Electrification can be an important strategy for climate adaptation, air quality improvement, and lower utility bills. However, electrification is not always guaranteed to be beneficial or cost less. The approach to electrification matters and is influenced by many factors such as timing, improvements to adjacent systems, and/or occupant/facilities manager buy-in. Significant barriers to electrification in schools include cost, technical constraints (such as rooftop space, replacing piping and ductwork, electrical infrastructure), lack of awareness, lack of workforce and lack processes that consider electrification. This paper more closely examines these barriers, reviews previous cost and technology considerations from the BETR report, and builds on that information with strategies to stack funding for addressing first costs issues.

Electrifying Schools

Barriers to Electrification in Schools

Adding to the work of the BETR report, researches have considered the barriers, and how to overcome them. Successful implementation of electrification projects in schools requires overcoming several barriers facing districts. Past K-12 market characterizations outline common barriers to green building and zero energy buildings in schools (Cortese 2018, Filardo 2021). These market barriers generally align with those that school districts will face with electrification, namely informational, technical, structural, and financial (EnergyStar 2024, CalMTA 2024). Each of these, as well as suggestions for how to overcome them, are described below. Financial barriers are more fully described in the sections that follow.

Informational barriers to implementing electrification projects stem from lack of knowledge related to the technologies necessary for electrification and a complicated decision-making structure in schools (Cortese 2018). Lack of knowledge among key decision makers may result in business-as-usual projects (fuel-fired and like-for-like replacements) over an electrification project during design and construction. Aside from decision-makers, the market also lacks qualified technicians for installation or operation of electrification equipment. New technologies and operational practices that are implemented in an electrification project will require a different knowledge base by operations and maintenance staff compared to more traditional fuel-fired equipment (Srivastava 2020). Without this knowledge, there may be hesitance to adopt new equipment and practices so training of operations and maintenance (O&M) staff, and workforce development will be crucial components for expanding the knowledge base of these professionals to facilitate market integration of the renewable energy and building electrification sector (Stojanovska-Georgievska 2020).

Sharing successes among districts is another way to overcome informational barriers. Organizational cross-collaboration is when staff from an organization new to electrification technology or system gains knowledge from O&M staff at another organization in the region where these same technologies or systems have been implemented. This opportunity to speak with those O&M staff about their experiences, challenges, and successes can be invaluable to overcome the lack of awareness barrier. Additionally, design and construction teams should carefully document trainings in the project closeout process, establishing a formal project hand off to the owner which can help to facilitate proper maintenance. This ensures that O&M staff feel comfortable operating the new equipment (Srivastava 2020).

Structural barriers are tied to functional, organizational, and other processes that would be necessary for successful implementation of an electrification project. These tend to be more systemic in nature, such as timing of the equipment to be replaced or the building owner's and project team's planning process for facility improvements. Certain building components and systems such as HVAC, structural components of the building, and fenestration may have much longer operating life cycles and are crucial to plan for in the electrification process.

Opportunities for overcoming structural barriers are centered around planning and establishing processes for consideration of electrification projects. An impactful approach is to establish standards and processes to routinely consider these technologies, especially during particular events that happen during a building's lifecycle. Design standards, including Owner's Project Requirements, Technical Guidelines, or other Technical Specifications that indicate specific equipment, design components, and operating conditions, are an important step for success (NBI 2022). The process for developing these guidelines will typically involve the necessary stakeholders for that technology (i.e., electrical and plumbing for electric heat pumps and heat pump water heaters, kitchen staff for electric cooking equipment, etc.), and those processes may already exist within the organization.

Establishing organizational goals and developing facility master plans to highlight specific components, systems, and buildings to be electrified at the relevant point in their lifecycle will prepare an organization for those changes (NBI 2022). Additionally, including a design charrette process that considers lifecycle costs for different potential facility improvement projects (including the electrification option) can bring together the necessary stakeholders, highlight their concerns, and allow for external experts (i.e., contract architects and engineering firms) to shed light on successes that other similar organizations have had in implementing any particular technology (Todd 2016).

Primary examples of *technical barriers* may include insufficient electrical infrastructure in the local or regional grid to support the project, or lacking district-owned infrastructure. While grid impacts from electrification projects (grid here defined as electrical infrastructure typically located outside the meter and owned by the utility company versus the building owner) have been considered in other research (Murphy 2021), electrical infrastructure inside the meter may also need to be updated at the cost of the building owner. One study found that some 12% of main service building panels, and 2% of unit panels are currently loaded above their nameplate ratings and will need to be upsized during electrification (Davis 2021).

For overcoming grid-related technical barriers, speaking to utility service providers early in the project is recommended. In some cases, utility infrastructure upgrades (e.g., larger service wires and/or transformers) may be needed, which can add time and cost to the project. Larger service ratings can also trigger changes to electricity tariffs and rates. Utility staff can help project decision makers understand these implications and help guide teams in making these decisions. For infrastructure inside the meter that will be the responsibility of the building owner, site audits and design document review early in the planning phase will be important to identify necessary updates and clarify impacts to cost and timing of the project. It should be noted that technical barriers may be further compounded in rural communities, leading to stagnant integration of these technologies. Certain equipment and parts for emerging technologies required in electrification projects, such as larger hydronic heat pump systems or certain electrified kitchen equipment, may not be readily available locally or may require long lead times (Streimikiene 2021).

Financial barriers for school electrification include upfront costs, ongoing costs, and split incentives between capital and operational school district budgets. Specific discussion of costs and opportunities for funding are explored further below, but Life Cycle Cost Analysis is one important planning approach to support decision making for electrification projects and should be considered by practitioners (Fuller 2016). As described in the following sections, upfront costs for many electrification projects may be higher than a comparable like-for-like replacement project. Electrification projects which only compare these upfront costs may be less likely to move forward based on this simple financial analysis.

Planning for Lifecycle Events

The electrification options for any project will depend on the available funding, goals, existing equipment, facility needs, and matters of politics and equity in a school district. The BETR for Schools report investigated the electrification of space heating, water heating, cooking, and transportation. Researchers sought out equipment to replace common gas-burning uses, including single zone and multizone heat pumps, ducted and ductless heat pumps, and central hydronic heat pumps for space heating; 120-volt and 240-volt storage heat pump water heaters (HPWH) as well as central HPWHs for water heating; a variety of commercial and smallscale cooking equipment including induction ranges and convection ovens; and both personal vehicle and school bus charging equipment. Electrification of these equipment types can align well with much-needed ventilation and indoor air quality improvements in schools and can influence which buildings to upgrade first in the district's portfolio (Rivera 2019). Electrification projects in schools will likely be tied to specific lifecycle events or facility upgrades when key building components are already being improved. Below, we describe four archetypal lifecycle events. These scenarios are not necessarily in order of priority or preference. For example, emergency replacements are usually not the best decarbonization pathway due to the tendency to pursue a like-for-like replacement approach, and the need to meet a compressed timeline and minimize first costs.

(1) *Emergency Replacement (ER) - Decision making priorities in this scenario: minimal upfront costs, non-invasive installation, readily available equipment.* This scenario refers to swift and unplanned replacement of existing equipment and assumes the selection of electric equipment that is the most "like-for-like" replacement to the existing equipment, but with an electric equivalent. ER is a common replacement scenario and necessitates minimal upfront cost premiums, non-invasive installation, and readily available equipment. If the existing space or water heating equipment is a complex, centralized system, immediate and full electrification may be challenging and expensive in the ER scenario. For these scenarios, it is important to develop multi-phase strategic electrification plans to decarbonize over time, such as further described in lifecycle scenarios 2 and 3, versus attempting to leverage ER as an opportunity for electrification of complex systems. If existing electrical capacity, appropriate outlets, and the necessary space for the new equipment are sufficient, hot water heating and commercial kitchen replacements may be electrification options in an emergency replacement scenario.

(2) *Planned/Routine Capital Improvement and Deferred Maintenance (PC) - Decision making priorities in this scenario: minimal upfront costs, non-invasive installation, lead time and planning for improved air quality.* This scenario applies to planned upgrades, as opposed to time-sensitive, emergency situations. In this scenario, energy reduction goals are not the primary consideration; instead, equipment replacement is driven by timing and budget. This scenario provides more flexibility to include measures like duct sealing and economizer replacements, in addition to the equipment upgrade itself, and the ability to replace complex central systems. It does not include deep retrofits. All technologies investigated in the BETR for Schools report may be good electrification options in a PC scenario (see Table 1 and Table 2). One key factor for successful PC electrification projects is to ensure any staff that will maintain and operate the new equipment or technology have an opportunity to tour (even if virtually) an existing facility with similar equipment in operation and speak with operations and maintenance staff who are already familiar with the equipment.

(3) *Efficiency & Cost Savings Project (Deep Efficiency Retrofit) (DE) - Decision making priorities in this scenario: lifecycle cost savings on utility bills and maintenance.* The DE scenario applies to planned upgrades, with a focus on lifecycle cost savings and where specific goals may be set such as energy efficiency or carbon reduction targets. This scenario provides the opportunity to electrify equipment and incorporate energy efficiency measures such as improvements to the building envelope, lighting upgrades, and improved control systems. When feasible, investing in energy efficiency measures can reduce the overall heating and cooling needs of the building, which helps to reduce capital and operating costs for mechanical equipment. This scenario may also be an opportunity to consider other decarbonization measures such as battery storage or electric vehicle charging infrastructure, especially if equipment electrification requires electrical service upgrades. For schools and districts with existing net zero energy, renewable energy, and/or energy storage goals, DE electrification projects covering the primary building systems (HVAC, building envelope improvement, lighting, cooking, etc.) are crucial before planning and design for the renewable and storage equipment, as the efficiency gains from the DE electrification project and electric load additions will greatly impact the sizing of renewable/storage systems.

(4) *Addition to Existing Building (AD) - Decision making priorities in this scenario: minimal upfront cost, lifecycle cost savings, improved air quality, fewer concerns of physical space or panel sizing, fitting in with existing systems.* The AD scenario addresses building additions or major alteration projects. These are similar to deep efficiency retrofit projects but reduce the complexity of working around existing physical or electrical constraints. In this scenario, electric equipment can be specified from the outset and included in a suite of optimization measures, while also including energy efficiency measures and consideration of strategies such as electric vehicle charging infrastructure. Like PC electrification projects, all technologies discussed in this report may be good electrification options in an AD scenario. New equipment and systems will need to tie into existing controls and infrastructure such as ducting and piping, which can pose a barrier and limit technology options.

Electrification Feasibility and Cost in Schools

The BETR for Schools investigated the costs of electrifying space heating, water heating, cooking equipment, and school transportation (NBI 2023). This section expands on and provides context for the costs presented in the BETR report. Researchers identified the appropriate electrification equipment for particular use cases before considering tradeoffs between existing gas equipment and electric equipment or upfront costs. The researchers also determined which existing gas equipment had a gap in electrification replacement options in the different scenarios mentioned above, and qualitatively judged the electrification options based on their ability to lower utility bills and improve IAQ. BETR for Schools also compared the relative greenhouse gas (GHG) reduction potential, although all of the electrification options are expected to at least have some GHG emissions savings compared to the existing gas equipment, with the magnitude dependent on the local grid mix. Table 1 generally summarizes the analysis from the BETR for Schools report (NBI 2023).

Table 1. Gas Equipment Replacement Feasibility and Potential Benefits

Existing Gas Equipment	**Emergency Replacement Electrification Option**	**Replacement Electrification Option**	**Electrification Option with:**		
			Similar First Cost	**Lower Utility Cost**	**IAQ Improvement**
Wall mounted A/C & gas furnace	Yes	Yes	Yes	Yes	Some*
Single zone A/C & gas RTU	Some	Yes	No	Yes	Some*
Multizone A/C & gas RTU	No	Yes	No	Yes	Some*
Central boiler	No	Some	No	No	Some*
Instantaneous gas water heater	Some	Yes	Some	Some	
Unitary gas storage water heater	Some	Yes	Some	Yes	
Central gas water heater	No	Yes	No	Some	
Small countertop gas kitchen equipment	Yes	Yes	Some	Yes	Yes
Commercial gas kitchen equipment	No	Yes	Yes	Some	Yes
Small gas laundry equipment	Yes	Yes	Some	Yes	
Commercial laundry equipment	Some	Yes	Some	Yes	

*The IAQ improvement from electrification in these cases relies on updated ventilation through the use of a Dedicated Outdoor Air System (DOAS) or (other ventilation system) in tandem with a heat pump system for space heating; Direct IAQ improvement is primarily associated with removal of fuel combusting equipment for the location(s) in which that fuel is combusted.

Currently, not all of the electrification options are cost competitive with their existing gas equipment counterpart, and not all of the electrification options inherently provide value in the form of reduced utility bills or improved air quality. Moreover, there are clear gaps in available and feasible electric replacements for central boilers and central gas water heaters.

Researchers found that to effectively decarbonize schools, there needs to be a concerted effort to effectively package indoor air quality and utility cost benefits along with the GHG emissions reductions to justify the increased first cost of the electrification options. In addition, the complications of designing and installing larger electrification equipment (central heating and water heating, commercial cooking and laundry equipment) must be addressed to remove barriers to electrification.

In addition to the first cost discrepancy between the existing gas equipment in schools and potential electric replacement options, the cost of the electric options typically has a larger range of outcomes, which adds risk to the investment for schools. This range is due to the possible need to upgrade other components of the mechanical system and electrical system to reflect new equipment sizing or loads as well as the need for more labor hours and a more complex set of variables required for commercial electrification solutions (Boma International, 2023). To help visualize this cost discrepancy, Figures 1 and 2 below show potential electrification scenarios that school districts may face. The BETR for Schools report gathered costs for Southern California (NBI, 2023). However, these costs have been adjusted to represent a national average using RSMeans city cost indices (Gordian, 2023). The costs listed in Figures 1 and 2 include both material and labor costs.

Figure 1 shows the normalized costs of replacing a multizone space conditioning system where the existing system is a rooftop unit (RTU) air conditioning (A/C) and gas heater. The potential electrification options evaluated included a RTU heat pump, and a multizone Mini split paired with a DOAS. The cost ranges are indicated by transparent gradient sections, and the costs outlined by dotted lines are dependent on the existing system. As shown in the charts, the first cost and the cost uncertainty are both higher for the electrification options. Costs will vary for both the existing system and proposed electric system based on the layout of the conditioned area and complexity of the conditioning needs. While this only shows one electrification scenario, it demonstrates that cost and financial risk are major hurdles to electrify a school HVAC system for building decarbonization.

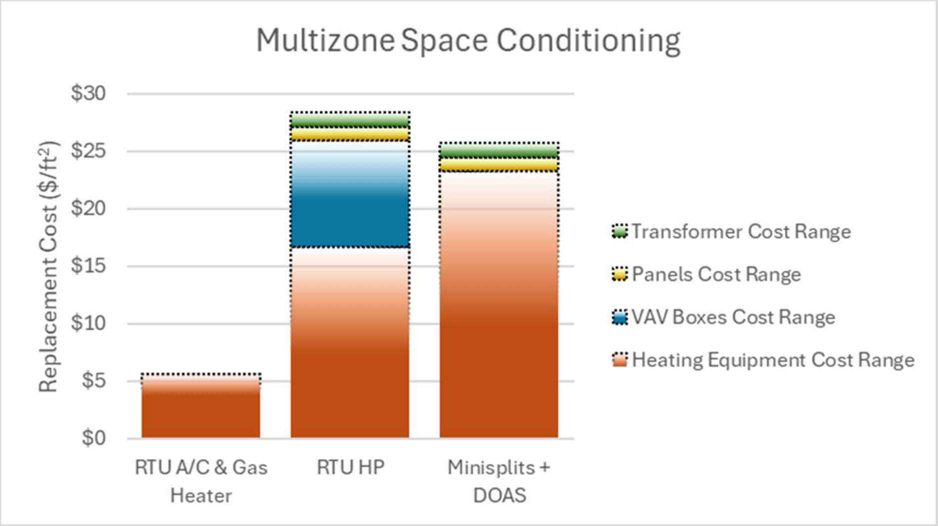

Figure 1. Potential Replacement Cost Ranges for Multizone Space Conditioning

Figure 2 shows the normalized costs of replacing a central water heating system. There is a similar trend to Figure 1 in terms of the incremental cost and uncertainty of the costs involved in the electrification option. In this case, however, the impacts of needing to upsize the electrical infrastructure in the school could triple the cost of the retrofit. This chart highlights the importance of taking incremental steps to electrification by first implementing readiness measures related to upgrading the electrical systems, increasing efficiency of the water and space heating systems, and implementing load flattening measures to ensure that the electrification systems being installed have the lowest capacity and peak load that is feasibly possible.

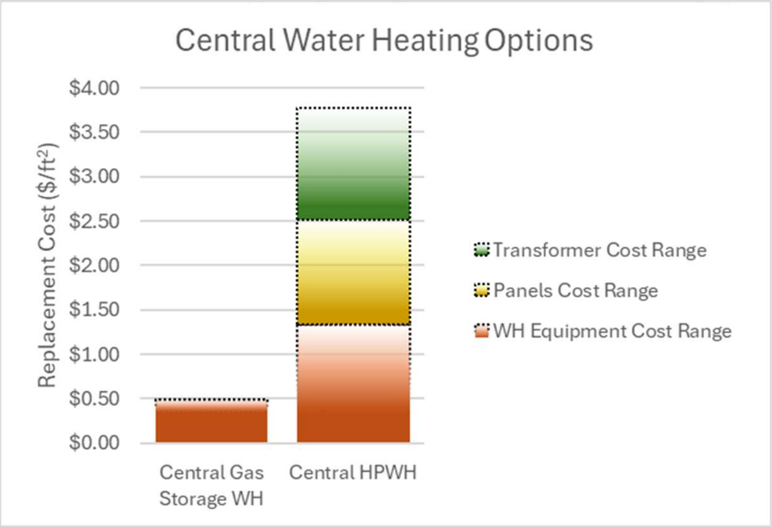

Figure 2. Potential Replacement Cost Ranges for Central Water Heating

Operating costs vary greatly depending on many factors including utility rates, climate zone, school/district operations (i.e. community use, summer vs. school year operations, four- or five-day school weeks, etc.), and the existing building characteristics. For this reason, operating cost implications in the BETR for Schools report are more generally categorized by how the given technology is likely to change utility costs as compared to the existing system, without any supplementary upgrades. One key opportunity related to operational costs and electrification, is the ability for an organization to stabilize its utility costs year-over-year, for ease in budgeting, contracting, and operational cost analyses (Boma International, 2023). High natural gas market volatility during the 2022 calendar year stemmed from factors well outside the control of any school district (U.S. Energy Information Administration, 2022). Electrification can help mitigate this volatility, as the electricity grid and associated market increases its resilience and diversifies its source energy to include a greater proportion of renewable energy for base load production.

Maintenance is another potential cost of electrification. New systems require upskilling and acquiring new knowledge and expertise for both installers and facility managers. For example, replacing a gas boiler and VAV boxes with multi-split heat pumps and dedicated outdoor air systems may reduce the complexity of the HVAC system, but will require knowledge of how to run and charge the refrigerant lines, interact with newer and different interfaces and controls systems, and stock different parts for repairs. Electric cooking equipment also requires an adjustment period. Different cookware may be needed, cook times and operations may be different with electric equipment, and the new equipment will still require staff training. All of these factors can add to the soft costs of an electrification project.

In general, the electrification retrofit options are mostly mature technologies, aside from some of the larger central heat pump plants and specialized commercial cooking equipment (Boma International, 2023). Focusing on decarbonization alone will not be incentive enough to overcome the barriers of incremental cost and installation complexity. These retrofits must be holistically developed through multi-stage planning and readiness measures, increased focus on workforce development for successful electrification installation practices, and a focus on co-benefits of electrification through decreased operational and maintenance costs and improvements to indoor air quality. Additionally, the newly available federal resources can be applied to decrease the barriers presented by the relative financial impact of electrification retrofits.

Stacking the Opportunities

Building on the cost and equipment considerations developed through the BETR report, this section further clarifies how schools and practitioners working with schools can fund these projects, which may not be economically competitive with traditional approaches. School districts can strategically use existing resources to build a foundation for continued progress to support efficient and resilient buildings. Demonstrating the tangible benefits of electrification reinforces a commitment to sustainability and supports the case for continued financial backing. Portfolio owners with successful experiences in getting to zero often begin with a decarbonization roadmap that identifies cost-effective strategies to reduce GHG emissions across a portfolio of buildings over time (Higgins 2021). Roadmaps outline a vision and serve as a blueprint for phased electrification projects. Schools experience a minimum annual funding gap of $38 billion for facility upgrades and repairs (ASCE 2021). Funding stacking, the process of utilizing multiple funding streams for a larger result, is necessary to fill these gaps. School districts often combine local bond revenues with state matching funds, utility incentives, and other grants to finance major modernization projects, although local funding is not always available. (Filardo 2021).

Some schools partner with Energy Service Companies (ESCOs) to establish Energy Savings Performance Contracts (ESPCs). Under the ESPC model, ESCOs conduct comprehensive energy audits to identify cost-effective improvements. They draft performance contracts that guarantee savings and will implement energy efficiency improvements, as well as monitor and verify savings. ESCOs can help fill financing gaps by providing capital, arranging third-party financing, leveraging utility incentives, and researching government funding (International Energy Agency 2018).

Historically, the federal government has played a minimal role in K-12 school facility upgrades, accounting for less than 2% of U.S. school district capital improvement funding from 2004 to 2010 (Filardo 2016). However, the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) represent significant federal investments in modernizing America's schools. Once project goals are defined, districts can apply for BIL/IRA funding opportunities. These include the $5 billion Environmental Protection Agency’s Clean School Bus Program that provides grants and rebates to replace school buses with zero-emission models from 2022 to 2026 (EPA 2024) and the Department of Energy’s (DOE’s) $500 million Renew America’s Schools Grant that provides funds for K-12 school energy improvements from 2022 to 2026 (SCEP 2024).While substantial, these funds do not cover the full costs of robust facility upgrades. Instead, they serve as foundational financing to which additional funding can be added.

The IRS-authorized "elective pay" or "direct pay" allows school districts to receive tax credits for clean energy technology installations after project completion. These non-competitive tax credits had been available to other tax-exempt entities like municipalities, but they were never before available to schools. The tax credit can cover up to 50% of project costs and be combined with other federal funding, with bonuses covering up to 70% of total project costs (Yanez-Barnuevo 2024).

For short-term or "bridge" funding while awaiting tax credits or rebates, school districts can consider loans. Despite high-interest rates, some institutions offer low-interest financing for electrification and renewable energy projects. State Energy Finance Institutions (SEFI), specialized state-level financial entities that support and facilitate investments in clean energy and energy efficiency projects, provide flexible, low-interest solutions to reduce financial barriers. Entities include State Energy Offices, Housing Financing Agencies, Green Banks, Economic Development Authorities, Energy Funds/Lending Centers, and other state agencies. The DOE Loan Programs Office also offers low-interest debt financing for large-scale energy infrastructure projects (Loan Program Office 2023).

Funding stacking has limitations, such as "double-dipping" restrictions and reduced state funding if other sources are secured, which can disincentivize pursuing efficient equipment. Additionally, state and federal funding have different project activity eligibility requirements, often require cost matching, and allocate funding on different timelines. Additionally, the administrative burden of navigating, tracking, and complying with various funding sources can be significant. Despite these challenges, funding stacking remains a successful approach for long-term school district upgrades.

Two examples of stacking funding from Oregon include a large urban district and a medium sized rural district. The large district recently passed several bonds totaling $1.98 billion to modernize four high schools, one middle school, and provide large incremental improvements across the district. The district additionally received $4.6 million in matching state grants which were contingent on bond passage, $200,000 from the Elementary and Secondary Education Relief (ESSER) Fund, and $2.6 million in incentives from the Energy Trust of Oregon. The rural district refers to its community as “tax averse” and has not been able to pass a bond in quite some time. Deferred maintenance at this district continued to pile up and funds were desperately needed to address thermal comfort, including air conditioning in some schools, poor indoor air quality, outdated lighting, and improved filtration to handle wildfire smoke. The district utilized a set of funding mechanisms aside from bonds including $4 million in ESSER funds, $130,000 in Senate Bill 1149 allocation from the Oregon Department of Energy, and $15.5 million in private low interest loans.

Conclusion

The urgency of addressing climate adaptation, indoor air quality, and utility costs in schools cannot be overstated. As evidenced by the crumbling state of school infrastructure and the critical importance of indoor air quality highlighted by the COVID-19 pandemic, there is a pressing need for action. Despite the relatively large financial investments from the federal government in schools, the available funding is only a small percentage of what is needed to overcome deferred maintenance and bring buildings up to standard. Schools do not have the capacity or expertise needed to apply for competitive funding or plan for and implement what is needed to secure IRA funds. This paper was developed to bring awareness of the financial constraints and capacity lacking in districts and how industry professionals can help provide support to aid districts in making cost effective, clean energy choices to best benefit their communities.

Building electrification, as the primary strategy for decarbonization in school buildings, can enhance educational environments and serve to address issues of air quality, facilitate climate mitigation, and reduce utility costs while also achieving capital improvement needs. Since not every electrification project will achieve all of these benefits, school districts must consider their unique circumstances and the lifecycle status of the equipment they seek to electrify. Setting decarbonization goals alone is not enough. Careful planning, staff training, and targeted resource allocation are required to balance educational, equity, and maintenance needs, and utilize funding strategically. Planning for lifecycle events and incorporating electrification strategies into routine capital improvements and maintenance projects can help minimize cost. By integrating electrification options into these processes, schools can gradually transition towards more sustainable and resilient infrastructure.

From a technology perspective, there remains a need to expand electric equipment options and improve these technologies to minimize the load increase on existing systems. Practitioners of facility improvement projects can carefully select and pair electrification measures with systems that add value to schools aside from decarbonization and can aid in characterization of school electrification under different operating scenarios and conditions through case studies and practitioner testimonials.

By encouraging districts to make the most of available funding and incorporating electrification into overarching policies and plans, districts can ensure cost-effective decision-making. By leveraging funding stacking approaches and tapping into available resources such as federal grants, tax credits, and low-interest loans, school districts can begin to address their electrification needs. Additionally, initiatives like Energy Savings Performance Contracts (ESPCs) offer a pathway to implement energy efficiency improvements while minimizing upfront costs.

Embracing electrification aligns with broader environmental goals, as it serves as a crucial step towards reducing GHG emissions. In forging a path toward sustainable, technology-driven, and equitable educational settings, school districts can simultaneously foster a more environmentally conscious future for entire communities. Electrifying schools is not a one-size-fits-all endeavor. It requires careful consideration of local contexts, available resources, and long-term goals. By taking a strategic and collaborative approach, school districts can pave the way for more efficient and environmentally sustainable learning environments for generations to come.

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