



Advancing Zero Energy Schools: Trends & Considerations for State School Construction Programs

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Table of Contents

Executive Summary	4
Introduction.....	5
State Profiles.....	6
Connecticut.....	7
District of Columbia.....	8
Delaware.....	9
Maine.....	9
Maryland	10
Massachusetts.....	12
New Hampshire.....	13
New Jersey.....	14
New York	16
Pennsylvania.....	17
Rhode Island.....	17
Vermont.....	18
West Virginia	19
Achieving Zero Energy Schools: Considerations for Statewide Programs.....	21
Energy Requirements	21
Data and Reporting	21
Condition Assessments, Facility Planning, and Credentialing	22
Funding and Financing Zero Energy	23
Promotional and Partnership Opportunities.....	23
Conclusion	24
Appendix: Resources	24



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About NEEP

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate regional collaboration to promote advanced energy efficiency and related solutions in home, buildings, industry, and communities. Our vision is that the region's homes, buildings, and communities are transformed into efficient, affordable, low-carbon resilient places to live, work, and play.

Disclaimer: NEEP verified the data used for this white paper to the best of our ability. This paper reflects the opinion and judgments of the NEEP staff and does not necessarily reflect those of NEEP Board members, NEEP Sponsors, or project participants and funders.

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Executive Summary

Across the country, state funding for school construction and renovation projects ranges significantly. According to the [State of Our Schools 2021 Report](#), from fiscal year 2009 through fiscal year 2019, 11 states did not contribute any funds to capital projects in school districts, while eight states paid over 50 percent of the cost of capital projects. On average, state contributions accounted for 22 percent of project costs across the country. However, the NEEP region as a whole had a higher rate of state contributions during that same period, averaging close to 60 percent. As indicated by the table below, extreme variability in state funding levels exists in the NEEP region.

State Contributions Towards School Construction Projects FY2009-2019	
State	Percentage contributed by state
Connecticut	84%
Delaware	71%
Washington D.C.	100%
Maine	100%
Maryland	31%
Massachusetts	63%
New Hampshire	51%
New Jersey	31%
New York	61%
Pennsylvania	20%
Rhode Island	100%
Vermont	16%
West Virginia	46%
Average	59.5%

While state-funded programs will inevitably vary, there are numerous opportunities for peer learning among state agencies & utility program administrators to advance the design, construction, and ongoing operations of zero energy schools. This report summarizes how each state in the NEEP region currently approaches funding for school construction projects and provides a set of recommendations including:

- Establishing energy requirements – beyond the state’s energy code – for schools;
- Advancing data and reporting requirements to assess strengths and weaknesses of programs;
- Requiring a greater focus on operations and maintenance;
- Requiring workforce credentials;
- Streamlining funding and financing options between state agencies and others; and
- Facilitating engagement and learning opportunities amongst school projects



These recommendations provide opportunities to shift the current approach to school infrastructure investments because there is mounting evidence that the current system is broken. The important role that schools play in a community isn't supported by proper funding, as evidenced from [The Government Accountability Office reporting](#) that over 50 percent of public schools need to update or replace critical building systems such as HVAC systems. In fact, [The 2021 Report Card for America's Infrastructure](#) gives American schools a grade of D+ and the national [funding gap for public school facilities has increased from \\$46 to \\$85 billion over five years](#), according to the 2021 State of Our Schools Report. Discrepancies in funding are even more severe in districts serving low-income and rural communities; high poverty districts had 37 percent less money invested in school facilities improvement than low poverty districts, and rural districts with high poverty had about half the level of investment as the national average.

School buildings are important pillars of local communities. More than one-sixth of the U.S. population spends time in P-12 school buildings each weekday, in buildings that [affect occupant health, thinking, and performance](#). In addition, they serve as gathering places for community members. The importance of school buildings warrants leadership from our states and federal government to reconcile these funding issues.

Renovation and construction of public schools are funded in various ways within each of the 12 states and the District of Columbia. Projects, to some extent, are publicly funded by the residents and businesses of these jurisdictions. The expectation of these businesses and residents is that public resources are spent wisely. This report examines an important part of how these funds get used relative to energy-related systems but also recognizes that schools and funding programs are complex entities.

Introduction

The primary purpose of school infrastructure is to provide a safe space appropriate for educating students. In local communities, however, schools represent so much more than that. These facilities embody the priorities of public investment by our local and state leaders. Proper investment in school buildings can result in better educational outcomes, reduced environmental impact, enhanced occupant comfort, and other benefits to the greater public. While there are many important components of a school construction and/or renovation project, and available funds must be prioritized accordingly, investments in energy efficiency and clean energy can have a positive impact with widespread benefits and should be viewed as keystone requirements in any statewide school construction.

This report examines the current status of investments related to school construction programs at the statewide level. Information from each of the 12 states in the NEEP region, as well as the District of Columbia, highlights the multitude of approaches that states take to invest in new construction and major renovation projects. The report also details information related to utility programs, green bank programs, and other offerings that pertain to energy usage in schools. This report focuses solely on K-12 public school construction and renovation programs in the context of energy efficiency.

The current conditions of the region's school buildings emphasizes the need for change. Studies conducted within the past year highlight the challenges that school administrators are facing. Antiquated HVAC systems, inadequate building controls, inflexible spaces, and limited bandwidth are just a few of those problems that schools are dealing with today. These conditions lead to poor indoor air quality, unproductive learning and

teaching environments, inefficient use of energy, and other harmful environmental and societal impacts. In order to improve conditions and maximize the benefits of these buildings, leaders must update policies, innovate on existing norms, and expand investments in school facilities. This report has three primary objectives to help achieve these outcomes:

- Examine state approaches to construction and renovation projects for K-12 public schools, especially as it relates to energy efficiency and zero energy.
- Share best practices to advance policies that ensure students have access to clean, healthy, and safe learning environments that also support state and local clean energy goals.
- Help align state agencies with other funding providers (e.g. utility programs, green banks, etc.) to best assist communities with new construction and major renovation projects.

In a survey of sample school districts, the National Center for Education Statistics estimated that the average age of school buildings was 65 years old – putting the average date of construction for our nation’s schools at 1959.

According to the EPA, nearly one-fourth of school districts have one or more buildings in need of extensive repair or replacement and nearly half have been reported to have problems related to indoor air quality (IAQ).

State Profiles

The following section details school construction programs in each state within the NEEP region. Information on the design, construction, renovation, and operations of energy efficient or zero energy learning environments is presented at a high level. NEEP has verified this information to the best of our ability through research, and has requested review of each section by the appropriate state agencies.

The Key below indicates where important concepts can be found throughout this report. The icons shown in the State Profiles Section exemplify key aspects of real-world programs that correspond to recommendations in the following Considerations for Statewide Programs section.

Icon	Description
	States require school districts to build or renovate schools beyond the state’s base energy code.
	States require school districts to analyze and report their energy consumption.

	<p>States that require or promote school districts to conduct physical building condition assessments, long-term facility planning, and credentialing for building operators.</p>
	<p>States or other entities provide additional or innovative funding and financing options that enable schools to achieve zero energy.</p>
	<p>States engage in promotional activities by developing materials or conducting outreach activities, such as workshops, to promote best practices around zero energy schools to local districts.</p>

Connecticut

Connecticut’s Office of School Construction Grants & Review administers the state’s school construction grants, develops and implements the [School Construction Standards and Guidelines](#), and provides [other related services](#). The latest version of the School Construction Standards and Guidelines was released in 2016 and is intended to provide “consistent, clear information for LEAs [Local Educational Agencies] and design professionals to establish a uniform level of quality and cost for all of Connecticut’s public school buildings.” Referenced within the document are [Connecticut’s High Performance Requirements](#) (referred to as the CT HPB Manual).

The CT HPB Manual requires state-funded buildings be designed and built to a high performance building standard equivalent to that of the United States Green Buildings Council (USGBC) Leadership in Energy and Environment Design (LEED) Green Building Rating System – Silver. New construction projects with a total cost of \$5 million or more, and renovations totaling \$2 million or more that receive \$2 million from the state, are required to adhere to the CT HPB Manual. School buildings must meet 18 mandatory measures and 28 of 59 strategy options in the CT HPB Manual using one of three design alternative compliance pathways for schools – the Northeast Collaborative for High Performance Schools (NE-CHPS), LEED for Schools, and Green Globes.

In 2019, the State’s General Assembly passed [Public Act 19-35](#) which required an update to state high performance building requirements in order to help the state achieve its climate goals. The CT Department of Energy and Environmental Protection is undertaking a process to update the requirements.



CT utilities offer a number of different financial assistance options, as well as technical guidance for projects, to increase energy efficiency and add renewable energy generation to schools. Through the [Energize Connecticut](#) program, schools can take advantage of cash incentives for qualifying energy-savings measures, financing options through an interest free loan program, and innovative support programs like the Operations and Maintenance Program.

Recognizing the Importance of Operations and Maintenance

Energize CT Operations and Maintenance Program

Schools in CT can work with their local utility experts to identify opportunities for operational improvements. In some situations, the utility may even be able to provide outreach and training to local facilities staff. Energy efficiency measures may be available to offset project costs for some of the identified projects. Common projects include rewiring of lighting circuits for more effective controls and enhancements to a facility's energy management system.

Additionally, Energize CT promotes the [Building Operator Certification](#) training for facility managers.

NEEP resource: [Regional Operations & Maintenance Guide](#)

Another program offered by Energize CT, [eesmarts](#), helps educators teach their students about the importance of energy efficiency and renewable energy. This program serves as a model for integrating the physical building and its assets, into the school curriculum. Professional development is provided to educators at no-cost.

District of Columbia

New construction and renovations in the District of Columbia are handled collaboratively between D.C. Public Schools (DCPS) and the Department of General Services (DGS). [The School Modernization Manual](#) provides clear

Recognizing the Importance of Stakeholder Engagement

Washington D.C.'s School Modernization Manual calls for the establishment of a School Improvement Team (SIT) as part of each school construction/renovation project. The goal of the SIT is to ensure the community's values and perspectives are heard throughout the planning process and incorporated into the finished school. Approximately 10-15 individuals participate on each SIT and represent teachers, school leadership, parents, neighborhood organizations, and members of the project team. The SIT also acts as a liaison between the project and the greater public. [Learn more about SITs here.](#)

NEEP's [Community Action Planning for Energy Efficiency](#) (CAPEE) module on stakeholder engagement provides guidance for communities on how to successfully approach these activities to ensure positive outcomes.

and concise guidance on the entire process, including roles and responsibilities, community engagement, sustainability, and more. All capital projects must meet LEED Gold or higher.

DC school capital improvement projects are prioritized on an annual basis based by a data-driven assessment that includes considerations for equity (e.g. at-risk students, special education students, etc.), student demand (i.e. enrollment and building utilization), neighborhood population, and building condition. The DCPS is charged



with preparing a Capital Improvement Plan (CIP) annually. It is then finalized by the Mayor’s office and passed by the D.C. Council. The current model includes one year of planning and design, followed by two years of construction for each project. D.C. will use this process until 2024.

Starting in 2024, D.C. will use a new process called Planning Actively for Comprehensive Education Facilities (PACE). This new model requires D.C. to conduct a 20-year Master Facilities Plan and a six-year Capital Improvement plan with a new formula for prioritizing projects. More information about the new PACE model can be found [here](#).

Delaware

The Major Capital Improvement Program, [Section 401 of Title 14 of the Delaware Administrative Code](#), applies to projects with a cost equal to or greater than \$750,000. School districts identify the need for a construction project and then submit a request to the state’s Department of Education. If approved by the state, the project is included in the following year’s budget. A standardized school construction formula based on pupil capacity for the type of school (i.e. high school, middle school, elementary) determines funding levels. Communities can reference the state’s [School Construction Technical Assistance Manual](#) for a complete guide on the process. Currently, there are no statewide requirements for sustainability or energy efficiency in schools. School districts must use the state’s standard bid and contract documents developed by the Office of Management and Budget Facilities Management but are allowed to make modifications, which could provide an opportunity to include energy requirements in these documents.

The Delaware Department of Natural Resources and Environmental Control (DNREC) administers the [Energy Efficiency Investment Fund](#) (EEIF) which provides multiple pathways for schools to improve their energy usage. Grants are categorized into four areas; (1) energy assessments, (2) prescriptive grants, (3) custom grants, and (4) combined heat and power. These grants can be combined with funds from the State Energy Program Revolving Loan Fund that school districts can utilize to install energy efficiency measures with low-interest loans. Revolving loan funds can only be used for existing buildings and do not apply to new construction. These funds are made available by the public utility tax paid by non-residential customers on their electric and/or natural gas bills. More information about these programs can be found [here](#).

The Delaware Sustainable Energy Utility (DESEU) and Green Building United have collaborated to bring a program called [Pathways to Green Schools](#) to Delaware districts. This program provides grants, technical support, and expert resources to help schools become healthier, more sustainable, and more energy efficient. Schools in the program work towards achieving a [US Department of Education Green Ribbon School](#) award.

Maine

Maine’s school construction and renovation programs are managed through the Department of Education’s Office of Facilities and Transportation. The two primary programs from the state are; (1) the School Revolving Renovation Fund and (2) the Major Capital School Construction Program.

Projects utilizing state funds must adhere to the [energy efficiency standards](#) as defined in 5 M.R.S.A. §§ 1762-1769. These rules incorporate three main components related to energy efficiency:

- (1) Consideration of architectural designs and energy systems that show the greatest net benefit over the life of the building by minimizing long-term energy and operating costs;

- (2) Include an energy-use target that exceeds by at least 20 percent the energy efficiency standards in effect for commercial and institutional buildings pursuant to the Maine Uniform Building and Energy Code.
 - a. Note: The state of Maine utilizes the 2021 IECC and while the above rule is still accurate, schools are not currently being designed to exceed this version of the code by 20 percent;
- (3) Include a life-cycle cost analysis that explicitly considers cost and benefits over a minimum of 30 years and that explicitly includes the public health and environmental benefits associated with energy-efficient building design and construction, to the extent they can be reasonably quantified.

Maine regulations allow communities to use state funds for building commissioning. The commissioning process helps to ensure the building and all of its core systems, such as HVAC, controls, etc., are operating as intended by the design and construction teams. It is a quality assurance process that gets completed by a trained professional (i.e. commissioning agent) after construction has concluded, but prior to the building being occupied. The process seeks to correct any issues related to energy efficiency, system breakdowns, or maintenance needs. Commissioning is a critical part of ensuring success in a high performance or zero energy school project but can be viewed as an added expense to a project.



All School Administrative Units (SAUs) in Maine must conduct long-term management plans for their facilities including both facility maintenance plans and capital improvement plans. The 10-year capital improvement plans must include an analysis of energy conservation measures. SAUs are required to verify their compliance with this rule every three years but do not have to submit their plans annually. By requiring these plans to be developed at the local level, the state is signaling the importance of routine maintenance, preventative maintenance, and proactive planning to ensure buildings are operating as healthy, efficient learning environments.

Maryland

In 2018, the passage of the [21st Century School Facilities Act](#) led to the creation of the Interagency Commission on School Construction (IAC). This commission is tasked with administering several state programs related to the construction, renovation, and operation of school facilities. A summary of all IAC initiatives can be found [here](#). The largest of these programs is the Capital Improvement Program (CIP) which allocates funds for new, replacement, and capital maintenance projects.

The IAC adopted the [Maryland Educational Facilities Sufficiency Standards](#) in 2018 as the minimum level of acceptable conditions pertaining to the physical building, capacity, and educational suitability of the spaces. These standards include limited specifications for items pertaining to the well-being (e.g. acoustics and air quality) and energy efficiency of buildings (e.g. HVAC and building envelope). The IAC periodically reviews and updates these standards.

To support the minimum standards in the Educational Facilities Sufficiency Standards noted above, the IAC also maintains the [Facilities Planning Guide](#) to assist local education agencies (LEAs). This guide contains more information about energy consumption in schools, noting that “school buildings must be designed to optimize energy use and minimize utility costs”. Also noted is the requirement that schools conduct a life-cycle cost analysis and energy consumption analysis for any project that utilizes state funding. Further, Section C of this guide contains information related to building performance which specifies that new schools receiving state funds should be constructed as a “high performance buildings” defined as meeting one of the criteria below:

- Meeting or exceeding LEED Silver;
- Achieving at least a comparable numeric rating according to a nationally recognized, accepted, and appropriate numeric sustainable development rating system, guideline, or standard approved by the Secretaries of Budget and Management and General Services;
- Complying with a nationally recognized and accepted green building code, guideline, or standard reviewed and recommended by the Maryland Green Building Council and approved by the Secretaries of Budget and Management and General Services.



[House Bill 630](#), passed in 2021, requires each local school district to adopt and update an energy policy starting on July 1, 2022, and every three years afterwards. HB 630-also requires that LEAs report their energy consumption data to the state on an annual basis. The state will develop a standardized template to aid with the energy policy’s reporting requirements. Mandated requirements of the energy policy include:

- Addressing the purchase, conservation and efficiency of energy for the district;
- Monitoring overall electricity consumption and as it relates to renewable energy;
- Current and historical energy use by square foot data.

While not mandated by HB 630, each district is encouraged to set targets to increase the district’s reliance on renewable energy and targets for greenhouse gas emission reductions across the entire portfolio. The state is also charged with studying and making recommendations related to expanding and funding the Maryland Net Zero Energy School Initiative Grant Program in the future.

Piloting Zero Energy

[Maryland’s Net Zero Energy School Initiative Grant Program](#) was created in 2016 through a partnership between The Maryland Energy Administration (MEA) and the Public School Construction Program (PSCP) to support the design and construction of the state’s first three new net zero energy schools. The Maryland Public Service Commission approved the use of \$9 million of funding from the Customer Investment Fund, a financial resource for long term energy efficiency and conservation investments, for the projects. Schools were chosen based on their district’s interest in the program, the proposed construction timeline, location, and the likelihood of the school achieving net zero energy status. In 2017, the new Wilde Lake Middle School was finished and it has achieved net zero energy status. [In 2020 two schools in Baltimore City](#), Graceland Park/O'Donnell Heights Elementary/Middle School and Holabird Academy, were also completed.

On May 30, 2021 [Maryland House Bill 630, Primary and Secondary Education – School District Energy Use – Policy and Study](#), passed. In part, the bill requires the Interagency Commission on School Construction to coordinate with the Maryland Energy Administration and the Maryland Clean Energy Center to study and make recommendations regarding how to expand the MD Net Zero Energy School Initiative Grant Program and provide additional funding for it. The report is due December 1, 2021.

Massachusetts

The Massachusetts School Building Authority (MSBA) is a “quasi-independent government authority” tasked with funding capital improvement projects in the state’s public schools. The mission of the organization is to create affordable, sustainable, and energy efficient schools across Massachusetts. The MSBA has made more than \$15.3 billion in payments to cities and towns in Massachusetts since 2004.



The MSBA has two primary programs to fund new construction and renovation projects including the Repair Program and Core Program. The Repair Program is broken down into two categories – major repairs and accelerated repairs – differentiated by the scope of updates and timeline. All MSBA core funded projects must achieve NE-CHPS Verified or LEED-S Certified including achieving an energy performance 10 percent better than that of the current state energy code. For an additional two reimbursement points from MSBA, projects must achieve at least 20 percent above the current MA base energy code utilizing the requirements in NE-CHPS or LEED for Schools to substantiate this reimbursement.

Building commissioning is a critical part of new construction and upgrade projects in schools and is crucial in ensuring that zero energy or high performance projects are operating as intended. MSBA requires that districts undergo commissioning and funds 100 percent of the process. MSBA provides a suite of resources, including a vetted list of commissioning agents and other resources to help districts through this process. MSBA has also recently added a new [POE \(Post Occupancy Evaluation\) program](#) in which all recently completed MSBA schools are evaluated for compliance with design standards such as maintenance, durability, space utilization, operability, energy efficiency, and more. One of the objectives of this program is to produce a database of findings that improve the school design process for future projects.



In addition to its core funding programs, MSBA also promotes sustainable building practices through a few different efforts. Its ongoing program, [A Story of a Building](#), engages participants from design teams and communities in a conversation where they can learn from one another about the experiences of past projects and tour recently completed projects. Lastly, MSBA has demonstrated a commitment to transparency by publishing data related to the cost of school construction in Massachusetts. [Its interactive tool](#) enables users to compare data dating back to 2009.

Other funding opportunities exist in Massachusetts that local school districts can leverage for clean energy improvements. These opportunities include the MA Green Communities Program and Mass Save Program. Municipalities receiving the Green Community Designation from the MA Department of Energy Resources receive an initial grant in the amount of \$125,000 (or more depending on the community’s population and per capita income) which can be used towards energy efficiency upgrade projects in schools. After this initial grant award, municipalities can apply for annual competitive grants from the Green Communities Program with new awards capped at \$200,000. These grants can be combined with other forms of funding from state or utility programs.

Mass Save is a utility-sponsored program in Massachusetts that recently launched a [Zero Net Energy/Deep Energy Savings](#) pathway in which schools can participate. The goal of the program is to offset project costs by providing the highest level of incentives to projects that are seeking zero energy performance. Mass Save also emphasizes the importance of verifying zero energy post occupancy by providing additional incentives (\$1.00/sf) for those projects that prove they successfully achieved their target EUI. Projects that participate in this program must commit to achieving an energy use intensity (EUI) target of 25 or below.

New Hampshire

The New Hampshire Department of Education manages the state’s primary funding pathway for school construction. The School Building Aid program directs state funds to local school districts to build new schools or renovate existing facilities. The program was in moratorium from 2010-2019 due to rising construction costs and economic instability occurring at that time. The moratorium was lifted in 2020\$8.6 million was appropriated for new projects, and three new projects were funded. The specifics of the School Building Aid program are detailed in [Ed 321](#). The state produced an [Overview of the School Building Aid Process](#) to clearly explain key dates and actions that must be completed throughout the application process.

School districts must complete a [detailed application](#) which requires district actions regarding energy efficiency. First, districts must describe current energy use of the school and proposed energy use based on details of the project. The state encourages schools to benchmark their facilities utilizing EPA’s ENERGY STAR® Portfolio Manager. School districts that indicate their commitment to energy efficiency upgrades can receive higher rankings for this portion of the application. Next, the state requires districts to submit documentation with their application that indicates contact with the local utility to discuss rebates and assistance for energy related projects. Even if a community was not aware of the offerings from their utility at the beginning of this process, the state’s mandate to contact their utility ensures the district is taking advantage of as much funding to upgrade to the most efficient technologies. Requiring this collaboration during the building aid application process also ensures utilities are included in the school construction project at an early stage which is critical to successful energy improvement projects.



The state of New Hampshire shows its commitment to the ongoing operations of school facilities by promoting two distinct training programs for building operators. The first is the widely recognized [Building Operator Certification](#) (BOC) program offered by Lakes Region Community College in partnership with NHSaves. The NH Department of Education provides updated information on the BOC program directly on the state webpage. The second training is the NH Association of School Business Officials (NH ASBO) [School Facilities Certification Program](#). This program offers two levels of courses – one for less experienced facility maintenance staff and lead custodians, and a second for more advanced professionals such as facility directors. Both of these training programs help ensure the building operators of NH schools are well-suited to properly maintain the state’s and community’s investment.

The NHSaves program is funded by electric and natural gas ratepayers in New Hampshire with the purpose of making homes, businesses, and towns more sustainable and comfortable places. Schools can participate in four different pathways as a part of the [Commercial New Construction or Major Renovation program](#), one of which is specific to helping buildings achieve zero energy. At least one new school in NH, [Oyster River Middle School](#), is in the process of constructing a zero energy school using assistance from this program. The [New Equipment Program](#) is targeted at existing school facilities that are replacing outdated, inefficient building systems.

Lastly, the Community Development Finance Authority provides technical and financial resources to municipalities for energy efficiency and renewable energy investments. Through the [Clean Energy Fund](#), schools can receive low-interest loans, guidance to coordinate with multiple sources of funding, and technical assistance to all members of a project team. Eligible projects must result in at least 15 percent energy savings and are encouraged to meet standards such as Passive House, ENERGY STAR®, LEED, or Zero Energy.

New Jersey

Public schools construction projects are funded through two distinct agencies in New Jersey. The New Jersey Schools Development Authority (NJ SDA) is tasked with funding 100 percent of the project cost in 31 school districts (known as Abbott districts, or SDA districts, due to their historically inadequate education facilities). The NJ SDA provides all other districts with grants up to 40 percent of total project cost. The state’s Department of Education works in close collaboration with NJ SDA on school construction, funding, and prioritization.

The state has a set of [educational facilities standards](#) which all schools must follow if receiving state aid. As part of these standards, the SDA has committed to building [sustainable schools](#). LEED Certification, commissioning, and post-occupancy evaluations are all components of the sustainable school guidelines.

Sustainable Jersey for Schools is a certification program that school districts can participate in to take action, access resources, secure grants, and gain recognition for working towards a sustainable future. Most grants are used for projects that support a school’s progress towards one of the Sustainable Jersey actions, including energy efficiency. In 2021, Sustainable Jersey offered free direct technical assistance to schools on energy initiatives. Support through this program is also for linking school districts to opportunities from the NJ Clean Energy Program and incentives available through local utilities.



The [New Jersey Clean Energy Program](#) provides multiple programs for local public entities, including schools. Programs are broken down into existing buildings and new construction. Schools can take advantage of programs including free benchmarking assistance, in-depth energy audits, incentives for energy efficient systems, and more. The [Pay for Performance Program](#) (P4P) is a longer-term approach to whole-building energy efficiency improvements. Schools can receive energy reduction plans from qualified vendors that provide a technical analysis, financial plan, and construction schedule for the project. Existing buildings participating in this program must achieve at least a 15 percent energy reduction, while new construction must achieve a five percent energy savings compared to the state’s base energy code (ASHRAE 90.1-2016). Achievement of these targets are verified post-occupancy by using EPA’s ENERGY STAR® Portfolio Manager. Incentives are awarded to participating customers that achieve three milestones including upon submission and approval of the energy reduction plan, upon confirmation that energy efficiency measures were installed, and lastly for demonstrating achievement of the energy reduction goal by submitting the ENERGY STAR® report.



Friends Seminary

New York, New York

General Information

Location: 222 East 16th St, New York, NY 10003

Building Size: 76,521 ft²

Completion: September 2019

Enrollment: 780 (k-12)

Architect: Kliment Halsband Architects

Funding/Grant: NYSERDA

EUI: 15.5 kBtu/ft²

Design Criteria: NE-CHPS Verified

Project Overview

Friends Seminary completed a major renovation project in September 2019, transforming the historic school into a modern high performance building. The project maintained the three original townhouse facades while redesigning the internal structure and adding multiple stories to the buildings. In doing so, the school retained its historic significance while serving as an exemplar for adaptive reuse and high performance construction.

Working within construction limitations due to the area's landmark designation, Kliment Halsband Architects was able to make many energy efficient and sustainable design decisions. First, by

minimizing demolition, the school was able to reuse much of the existing structure in the final design. The newly-constructed area features roof planters to help insulate the building and minimize thermal heat gain, which reduces heating and cooling requirements. School-wide improved wall and roof insulation aids in mitigating the structure's energy demand as well.

Strategic use of skylights in the gallery connecting the old and new buildings reduces electricity demand for lighting. LED lights with controls throughout the rest of the building further decrease the school's energy consumption. These efficient design elements allowed the renovated school to achieve an impressive EUI of 15.5 kBtu/ ft².

In addition to saving money, the redesigned building takes into account student wellness in a variety of ways. Low-to-zero VOC paints and sealants and effective use of daylighting improve the quality of indoor air and lighting. The historic façade's double skin, well insulated walls and roofs, and high solar reflectance improve thermal comfort. In addition, the expanded gym, yoga, and dance facilities, along with a rooftop terrace, greenhouse, community space, and a Great Room opening into the central court, offer students ample open space for activities.



New York

School building aid is provided through the State Education Department as indicated in [Part 155](#) of the Regulations of the Commissioner of Education. The state published the [Manual of Planning Standards for School Buildings](#) (The Manual) but the last listed update is shown as March 1998. The Manual instructs school buildings to “use design principles and construction materials which further the goals of conserving energy, ensuring good indoor air quality”. The Manual mentions energy conservation and efficiency related to specific building systems on various other occasions throughout the document.

NY state mandates that each school district prepares a five-year capital asset preservation plan and updates it annually. The asset plan includes information related to proposed capital projects, operations and maintenance, energy consumption and sources, and an inventory of district-wide assets.



The New York State Energy Research and Development Authority (NYSERDA) manages a [P-12 Schools Initiative](#) focused on helping school districts (pre-kindergarten through grade 12) adopt strategies to reduce energy consumption and to install clean energy systems. The benchmarking program is designed to make it easy for schools to track and analyze their energy data. Schools that participate in this program will have their utility data entered into the benchmarking tool every six months and will gain access to trend reports. From there, schools can opt to have an operational assessment that will provide building-specific recommendations. The program helps schools understand their energy use and identify inefficiencies.

A second NYSERDA initiative, the [Green and Clean Energy Solutions](#) program provides financial support for eligible projects including energy studies, clean heating and cooling, and net zero energy design, and incentives for energy load reduction projects. NYSERDA provides cost-sharing of up to 75 percent (or 100 percent for “[high-need](#)” schools) for energy studies and clean heating and cooling and net zero design projects. Clean heating and cooling design projects may include geothermal, air source heat pumps, variable refrigerant flow, or other projects demonstrating space and/or water heating or cooling without the use of fossil fuels. Schools seeking to achieve zero energy can utilize funds from this program to pay for designs, modeling, integrated project delivery and more. Additional details about the program can be found in the [program opportunity notice](#).

In addition to the P-12 Schools Initiative, NYSERDA provides additional resources and supports several other relevant programs related to schools. Of most relevance to this report are the [On-Site Energy Manager Program](#) and the [Building Operations & Maintenance Program](#). Other offerings can be found on the bottom of the [P-12 Schools page](#).

With over 1,500 school buildings in its portfolio, New York City plays a large role in the state’s efforts to advance energy efficient new schools and retrofitted existing schools. The NYC School Construction Authority’s [Green Schools Guide](#) outlines standards for sustainable design and construction of energy efficient, high performance schools. The NYC Department of City Administrative Services administers additional funding earmarked for carbon and energy reduction measures in city-owned buildings, including energy retrofits in schools. To further support schools, the NYC Department of Education’s Office of Sustainability manages programs, resources, and trainings to support school sustainability efforts across all stakeholders which is detailed in the [Annual Sustainability Report](#).

Pennsylvania

Pennsylvania places much of the onerous on the Local Education Authority (LEA) when it comes to funding the construction of new school buildings. However, when an LEA is planning a new construction, addition, renovation, or alteration project, it may seek reimbursement from the state through the PlanCon program (Planning and Construction Workbook). There are four parts to the PlanCon program required by the Pennsylvania Department of Education including; (1) project justification, (2) construction documents, (3) project bid awards, and (4) project completion. Projects can adhere to high performance building standards on a voluntary basis for a 10 percent subsidy enhancement. Acceptable standards include LEED, Green Globes, and other high performance standards if they meet or exceed those listed previously. [Act 70](#) of 2019 created the maintenance program as a supplementary program to PlanCon which enables LEAs to apply for grants to tackle energy savings projects. Currently, the PlanCon program is in moratorium.

The Pennsylvania Department of Environmental Protection (PA DEP) provides information to schools that are interested in taking on energy improvement projects. The [Government & Schools webpage](#) details easy-to-understand information about energy efficiency and conservation measures. The information is categorized by project type including lighting, HVAC, controls, and more. PA DEP also has grants and technical assistance opportunities for schools but funds and availability may be limited depending on the year. More information can be found on the [grants webpage](#).

Rhode Island

The Rhode Island School Building Authority (RI SBA) is committed to providing high quality educational spaces that conserve natural resources, consume less energy, and enabled simplified maintenance procedures. RI SBA manages two separate funding pathways for public schools, including the Housing Aid Program and the School Building Authority Capital Fund. Local Education Agencies (LEAs) begin this process by completing the Necessity of School Construction application, which includes working with architectural and engineering teams to develop plans for the construction project.



In 2016, Rhode Island completed a facility assessment of all 306 public school buildings across the state. The [comprehensive study](#) examined the educational appropriateness, capacity, condition, life cycle forecast, and enrollment projects for each facility. In total, the combined five-year need for all public schools, as determined through the facility assessment, is \$3 billion. Data gathered through the facility assessment is available on the [RI SBA website](#). The study also closely examined [energy usage in each of Rhode Island's school buildings](#) and identified six primary ways that schools can save money and reduce emissions. The study provides a pathway for schools to save \$33.6 million dollars annually and achieve zero energy.

The state used the facility assessment to devise a plan and increase investments in school facilities. The result was the approval of [Article 9](#) which significantly amended the approach to funding school construction in Rhode Island. Additional changes and new requirements have been added to Article 9, including the approval of a \$250 million [Statewide School Construction Bond](#), establishment of minimum maintenance funding requirements, additional requirements for contractors and Owner's Project Managers (OPM), changes to reimbursement calculations, and a requirement for quarterly progress reports during ongoing projects.

The [School Construction Regulations](#) adopted in 2007 established Rhode Island's commitment to creating high quality learning environments. These regulations state that all new school construction and renovation projects



that exceed \$500,000 must meet all requirements in NE-CHPS v3.1. The state provides additional reimbursement for districts that achieve higher levels of energy efficiency (section 4.12.2 of the School Construction Regulations). For example, a project that achieves a 30 percent increase in energy efficiency compared to the RI energy code is eligible to receive an additional two percent reimbursement on the project.

There are supplementary options for communities in Rhode Island seeking to increase energy efficiency in school facilities. The Rhode Island Infrastructure Bank (RIIB) and Rhode Island Office of Energy Resources (RIOER) administer the Efficient Buildings Fund (EBF) which is a revolving loan fund that local governments can leverage for energy efficiency and renewable energy projects. Program applicants must work with local utility National Grid to conduct an energy audit of their facilities. The program strives to impart long-term energy considerations for participants by requiring energy usage reporting for five years after the loan closing and by requiring the development of an energy management plan by the loan borrower.

Vermont

The Vermont Agency of Education manages the state aid program that funds school construction and renovation projects. The program has been in moratorium since 2007, leaving VT communities with the burden of repairing, constructing, and funding capital projects. State assistance is only available for emergency projects under \$100,000 that “address immediate health and safety threats to students and employees” – such projects are eligible for 30 percent school construction aid.

The State Board of Education developed the Manual of Rules and Practices related to [school buildings and sites](#) to encourage construction and renovation projects that are cost and energy efficient. The manual sets forth the requirements that projects must meet for state aid and details a criteria for ranking priority projects. Amongst the requirements are some provisions related to energy consumption in buildings. The manual specifically calls out energy retrofit projects as an allowable expense for state aid, as long as said project meets a cost effectiveness test.

In 2008, the Vermont Department of Education published the [School Construction Planning Guide](#) as a reference for school boards and administrators. This resource recognizes the complexity of undertaking a project at the local level and provides clear guidance for stakeholders to successfully navigate through each step of the process. In particular, the resource provides detailed recommendations for engaging with architects, consultants, and all of the VT state agencies (including the VT Department of Public Service which assists with energy efficiency components of the project) that can be involved in the school construction process. This resource, although a bit outdated, can be a highly valuable guide for communities that embark upon school construction projects on a very infrequent basis.

Schools may also be eligible for rebates, incentives, technical assistance, and resources from [Efficiency Vermont](#). Assistance may be provided for new construction projects and for system replacements. In 2020, the VT state legislature directed funds to Efficiency Vermont’s [School Indoor Air Quality Grant Program](#). This short term funding aimed at making HVAC systems in schools align with the guidance from ASHRAE and the Center for Disease Control.

West Virginia

The West Virginia School Building Authority (SBA) provides funds for the construction and maintenance of school facilities across all 55 counties in the state. There are several funding mechanisms in place for projects with [Needs Grants](#) as the primary pathway for funding major capital improvements. The state maintains the [Policy Procedures Handbook](#) which provides thorough information related to the SBA funding process, application requirements, and the roles of key project participants. Each Local Education Agency (LEA) is required to develop and submit a Comprehensive Educational Facilities Plan (CEFP) to the state every 10 years.



West Virginia has established an annual [energy reporting requirement](#) that pertains to all SBA-funded projects involving the total renovation or replacement of HVAC systems. Such data is gathered to help LEAs understand which systems and equipment should be prioritized in the future. Requirements for utilizing state grants in coordination with Energy Performance Savings Contracts (ESPCs) are also listed in the handbook. LEAs can utilize the template RFP which helps to simplify the process for school districts seeking to work on ESPCs.

Utilizing school aid means that LEAs must adhere to the [Quality and Performance Standards](#) from the WV SBA. This document was published in 2008 and last updated in 2013. These standards outline certain requirements for energy systems including aligning projects with the latest ASHRAE 90.1 standard that has been adopted by the state and commissioning requirements for HVAC projects that cost more than \$1,000,000.



Figure 1 Image courtesy of Tappé Architects

Achieving Zero Energy Schools: Considerations for Statewide Programs

The following section provides insights into how the region can move closer to achieving zero energy schools in statewide school construction programs for new construction and major renovation projects. The challenges and recommendations described throughout this section reflect lessons learned and best practices gained through independent research, conversations with relevant stakeholders, and a survey of different perspectives in the region. In keeping within the scope of this report, the considerations below are targeted towards improving components of school construction programs to create a holistic approach to creating healthy and efficient learning environments that engages multiple stakeholders and state agencies that have an impact on building energy consumption.



Energy Requirements

Some, but not all, states in the region require new schools and major renovations to be built beyond the requirements of the state’s energy code. Several states require new schools to meet a green building standard such as NE-CHPS or LEED for Schools. States such as MA and RI incentivize higher levels of energy performance by providing additional reimbursements to districts. In NH, projects can receive a higher priority ranking if energy efficiency upgrades are proposed on building aid applications. There are many different approaches to requiring a certain energy performance for a statewide school construction program. Key factors to consider are the goals of the state and what is technically feasible for school districts, design teams, and construction professionals.

Historically, zero energy schools have been pursued in communities that have resources and in-house expertise to take on these types of projects. Requiring or incentivizing zero energy or high performance schools at the statewide level will produce a more equitable pathway for districts that may not have access to funds or resources to create a zero energy school.

In addition to mandating energy requirements, these policies must be regularly updated. Many states have established energy requirements in the past that are now outdated or not required due to state level funding moratoriums. Policies and programs should be phrased such that allows for continuous updates as energy codes and green building standards are updated on a fairly regular basis. Just as educational priorities are constantly evolving, so too are the energy systems in buildings. Aligning programs with the latest standards ensures that school districts are focused on the latest industry best practices that will deliver the greatest benefits to their community. For instance, Rhode Island’s policy is linked to NE-CHPS v3.1 whereas the most recent version of NE-CHPS is v4.0. In West Virginia, the standards adopted in 2013 remain in place today. These misalignments can lead to lost opportunities for energy reductions, indoor air quality improvements, and educational benefits.



Data and Reporting

Undertaking a renovation or construction project is a monumental task for communities, especially those that have fewer school facilities and therefore build or renovate less frequently. States should seek to reduce the burden imposed upon school building committees and seek input from others that are involved in the process representing the community. Depending on the state, school projects may need to produce multiple energy models in order to document compliance with the state’s energy code, a green building rating system, and a utility program. States, utilities, and other funding providers must align so that schools can

easily comply with one statewide requirement. This also helps reduce administration costs and energy modeling requirements.

Through the management of these statewide school construction programs, there is an opportunity to collect substantial amounts of meaningful data on school buildings. In many instances, data such as basic building characteristics, utility expenditures, energy systems and technologies, maintenance costs, and more are unknown. Collecting and sharing this type of information can help in a variety of ways. It allows state agencies to track trends and progress towards goals but also to create plans for future needs where shortfalls exist in programs. Additionally, collecting post-occupancy data about energy consumption can help verify whether projects met intended targets. This process of data collection can be accomplished through annual surveys to school districts and through policy requirements as part of the school construction program. Statewide programs should encourage, or even mandate, that districts track and report their annual energy usage.

Building a database of information about school buildings will increase transparency about the successes of energy requirements and other programs and will encourage other districts to model their efforts on successful projects. Development of a statewide database with information about energy systems and consumption data may also assist with unforeseen circumstances, such as those presented by the COVID-19 pandemic. States can use this information to make data-driven decisions about funding needs and priorities in the future.



Condition Assessments, Facility Planning, and Credentialing

States should implement procedures that ensure proper maintenance for these public investments.

There are several integral factors when it comes to maintaining and operating a sophisticated, energy-efficient building. Consideration should be given to the following strategies to ensure long-term success of these projects.

- Conduct comprehensive statewide assessments
- Completing periodic assessments of all school buildings helps pinpoint inadequacies in educational facilities. The 2017 [State of Rhode Island Schoolhouses](#) report provides a detailed analysis of conditions of its schools and has helped the state develop an action plan for future upgrades.
- Require maintenance and capital improvement plans
- State Highlight: The state of Maine requires each school administrative unit to develop and update facility maintenance plans and capital improvement plans. The purpose of these plans is to ensure proper long-term management of these public investments. Learn more about Maine’s requirements [here](#).
- Require workforce credentials and on-going training
- When it comes to high performance and zero energy buildings, much of the focus is placed on the design and construction of the facility rather than the ongoing operations of such facilities. Districts that receive state aid should be required to properly train and certify their facility maintenance personnel.
- State Highlight: States should seek to partner with facility manager groups to promote trainings such as the Building Operator Certification (BOC). The New Hampshire Department of Education website hosts information about trainings available to districts. [Ohio law](#) requires that all state-funded buildings be managed by at least one Designated Building Operator certified under the BOC, and that building energy use be regularly monitored and compared to the baseline and previous year’s performance.

For more information on workforce training and credentialing see the workforce section of [NEEP's Operations and Maintenance Guide](#)

Using community-informed, local health information to understand student and staff needs can maximize the health benefits achieved through updates in building infrastructure and operations. **Community health assessments** use comprehensive data collection and analysis, proactive and diverse community engagement, and metric-identification to develop and implement strategies for improving local health outcomes. The [Healthy School Report Card](#) from ASCD is one tool that focuses on school infrastructure and how it impacts student and staff health and well-being and student learning.



Funding and Financing Zero Energy

In some instances, the amount of state aid available to communities can be reduced if outside financial assistance is secured. A state aid program may subtract utility rebates or other grants available to a school district from the total reimbursable cost of a project. This could ultimately reduce the reimbursement level from the state and disincentive districts from pursuing technologies that are more efficient and promoted through utility programs.

States should revise their programs so that communities can maximize different available funding opportunities. School districts should be encouraged to pursue funding from green banks or utility programs without the threat of losing funds through the state aid formula.

Furthermore, states should promote any available funding opportunities that school districts can utilize for achieving higher levels of energy efficiency beyond what the state government provides. States can do this by sharing relevant info on the webpages of school construction programs. Or, more directly, by requiring it as a part of the application for state aid. In New Hampshire, for example, there is a section of the application that asks whether school districts have contacted their local utility regarding incentive programs. The Massachusetts utility program offering for zero energy projects is another great example of how states are providing additional incentives for these types of programs. Further collaboration between utilities and state programs is encouraged.

The Maryland Energy Administration (MEA) and the Public School Construction Program (PSCP) collaborated on the Zero Energy Pilot Program to deliver additional funding to three zero energy school projects. Three schools have been designed and built to achieve zero energy performance. Maryland is now exploring options to continue this program. Additional states should look at this as a model to deliver these projects and demonstrate the feasibility of zero energy to other communities across the state.



Promotional and Partnership Opportunities

There are many market actors involved in delivering zero energy schools at a statewide level. The list includes various types of architects and engineers, construction professionals and other subcontractors, project consultants, numerous representatives from the school district, private citizens, state agencies, and more. Within these different stakeholder groups, there is a broad spectrum of expertise and



interest related to zero energy schools. As more stakeholders advocate for these types of projects and successes become more apparent, the market will continue to grow.

State agencies should take an active role in the dialogue to advance zero energy schools. In Massachusetts, the School Building Authority hosted an all-day webinar focused on [Demystifying Net Zero Energy](#) where many communities across the state gathered to learn about different approaches that schools have taken to achieve a zero energy facility. Content focused on considerations for energy efficiency and renewable energy technologies, operations and maintenance, community engagement, financing, and more. The New Hampshire Department of Education and school facility directors have ongoing dialogue around best practices for operations in schools. By leading these types of engagements, states can be on the front lines of a growing market.

Conclusion

Schools are one of the most important building types in the region because of the services they provide to the local community. School buildings provide a location where students spend significant portions of their young lives, teachers spend their professional careers, and community members gather for both joyful occasions and in times of need. Despite the importance of these buildings, it took the COVID-19 pandemic to shed light on the far-reaching deficiencies faced in the region's school buildings. While leaders in charge of state school construction programs are concerned with much more than just energy usage, it is a societal responsibility to advance school construction programs in a comprehensive and equitable manner. One core component of these programs must be related to energy as it has an impact on many different facets of a learning environment including costs, occupant health and productivity, environmental stewardship, and more. By examining programs from around the region, valuable insights and lessons can be shared with others to systematically improve school buildings and make progress towards achieving zero energy school facilities for all.

Appendix: Resources

Note: Below is a snapshot of resources available from NEEP, US DOE and EPA.

NEEP Resources

- [NEEP's High Performance Schools Website](#) contains a number of resources for state and local governments to put schools on the pathway to becoming healthy, energy efficient buildings.
- [Community Action Planning for Energy Efficiency](#) – helps communities plan for and prioritize energy efficiency projects.
- [Regional Operations and Maintenance Guide for Public Buildings](#) – this guide provides a set of strategies to improve the efficiency and health of public buildings.
- [The Northeast CHPS Verified Program \(NE-CHPS\)](#) was developed with input from regional stakeholders. NE-CHPS sets a high standard for energy-efficient and healthy learning environments while also streamlining the process for design teams and school districts.
- [ACE-In-An-Instant](#): A bi-monthly newsletter delivering the latest updates about the Achieving Community Efficiency (ACE) project straight to your inbox. Every other month, we'll bring you resources, data, case studies, and other highlights to keep you informed on how communities are leading the



development of a clean energy future. Sign up for the [newsletter here](#) or to learn more about the ACE Project, see the introductory blog [here](#).

- [Operating Guidance for Schools During the COVID-19 Pandemic](#) – a guide to support school boards, faculty, and facilities personnel with the operations of their school buildings during the pandemic.

U.S. Department of Energy Resources

Popular Tools and Resources from the State and Local Solution Center:

- [Energy Efficiency and Renewable Energy Resources for State and Local Resources](#)—The State and Local Solution Center provides resources to support the energy priorities of state and local governments. Download the resource guide to learn more about the State and Local Solution Center.
- [Toolkit: Energy Savings Performance Contracting \(ESPC\)](#) –The ESPC Toolkit provides resources for ESPC decision-making that were developed in collaboration with state and local partners from the ESPC Accelerator.
- [Current Practices in Efficiency Financing: An Overview of State and Local Governments](#) – Provides guidance to state and local governments as they determine which financing programs best suit their community’s needs.
- [Better Buildings Zero Energy Schools Accelerator](#) – Convened local, state, and national partners with the aim of making zero energy schools mainstream.

Environmental Protection Agency

- [Creating Healthy Indoor Air Quality in Schools](#) - EPA’s main page for healthy schools contains a variety of resources to help school districts and states consider the implications that school facilities have on students.
- [The Energy Savings Plus Health: Indoor Air Quality Guidelines for School Building Upgrades](#) – Helps school districts pair energy upgrade projects with indoor air quality improvements.