

From Outdated to Optimized

HVAC Solutions for Modern
School Challenges



INTRODUCTION

The Age-Old Crisis in School Buildings

Schools play a vital role in developing the adults of tomorrow, nurturing the next generations of doctors, engineers, teachers, and leaders who will shape our world. Yet, while education continues to evolve, ironically, many schools are stuck in the past when it comes to their infrastructure.

What do we mean by this? The average school building in America is 50 years old, with some predating World War II. More alarmingly, the American Society for Civil Engineers (ASCE) reported in 2021 that 53% of public school districts urgently need to update or replace multiple building systems, with HVAC infrastructure at the forefront of these concerns.

When 21st-century learning occurs in 20th-century buildings, the consequences extend far beyond discomfort. The adverse effects are felt across the board, impacting student health and academic performance, along with critical areas of school management such as budgeting, resource allocation, legal compliance, and school reputation.

While modernizing legacy HVAC systems may seem daunting, school operators are often surprised to find that the benefits outweigh the temporary challenges of upgrading. In fact, forward-thinking schools are discovering that modernizing HVAC solutions not only resolve current infrastructure issues but also position them for long-term success.

This eBook explores how modern HVAC solutions are specifically designed to meet modern schools' challenges. Equipped with this knowledge, school operators will feel more confident and prepared to implement these changes for the benefit of their students, staff, and the school as a whole.



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Modern Schools, Modern Challenges

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Addressing modern school challenges starts with recognizing the profound impact of aging HVAC systems, as these outdated systems intensify the very issues schools struggle to overcome.

Without proactive investment in HVAC modernization, schools risk compromising student health, academic performance, and operational efficiency. It seems that the path forward requires prioritizing long-term value over short-term savings.

Modern Schools, Modern Challenges

Every school wants its students to succeed, and to achieve that, schools must provide students with suitable conditions — from excellent teachers to excellent tools and resources.

The school's HVAC system is yet another crucial factor that can significantly impact students' success. When a classroom is better ventilated, flu, asthma, and absenteeism rates go down. When less carbon dioxide builds up, students can think more clearly, and test scores go up.

Despite their importance, managing HVAC systems presents numerous modern challenges for school operators, making it difficult to consistently create the ideal conditions for student academic excellence.

THE ROOT PROBLEM: AGING EQUIPMENT

As mentioned earlier, most school occupants spend their days in aging buildings with aging systems that can't meet their basic needs for health and comfort. To put this in perspective, according to a 2020 Government Accountability Office (GAO) report, 36,000 school buildings in the U.S. have substandard HVAC systems (approximately 41% of public school districts).

41%

of U.S. public school districts have substandard HVAC systems.

Aging HVAC systems are more than just an infrastructure problem. They catalyze a cascade of issues that directly impact students' lives. When these systems fail to maintain optimal temperature control

and Indoor Air Quality (IAQ), students are exposed to air pollution, mold, dust, pesticides, harmful gases, and asbestos. The stakes are exceptionally high for younger students, who inhale more air relative to their body weight than adults, making them more vulnerable to negative impacts, from health problems to diminished academic performance.

Classroom temperature also impacts student well-being and ability to learn. According to the National Bureau of Economic Research, every 1°F increase in the average school year temperature in schools without proper air solutions results in a 1% decline in learning outcomes. Sometimes, the consequences are severe enough to force entire schools to close. For example, in 2016, a 62-year-old elementary school in Millis, MA, temporarily shut down after mold and poor IAQ led to elevated levels of harmful chemicals.

Every 1°F increase in temperature without proper air solutions results in a **1% decline in learning outcomes**

AGING HVAC SYSTEMS EXACERBATE MODERN SCHOOL CHALLENGES

Teacher Shortage & Space Limitations

The nationwide teacher shortage has created a complex domino effect in America's educational system, with **86% of public schools struggling to fill positions and over 55,000 teacher vacancies** reported in 2023. This shortage has forced schools to increase class sizes, putting unprecedented strain on HVAC systems that must now maintain optimal conditions across larger spaces with more occupants. The challenge is particularly acute given that U.S. schools have already undergone massive consolidation, with 250,000 public schools reduced to approximately 98,000 over the past 80 years.

The space crunch in schools has reached critical levels. The U.S. EPA reports that educational facilities pack in four times more occupants than office buildings within the same floor space. These larger, more densely populated classrooms reinforce the

aging HVAC crisis and the urgent need to update or replace these systems to ensure proper air circulation and filtration.

Educational facilities pack

FOUR TIMES

more occupants than office buildings in the same floor space.

Climate Events & Environmental Compliance

As climate events intensify, schools face significant challenges due to extreme weather patterns. In 2023, the

U.S. already experienced the fifth-warmest year on record. Looking ahead, climate scientists project even more dramatic changes by midcentury, including several degrees of temperature increase, higher sea levels, and more frequent extreme weather events.

These weather shifts are further straining schools' already overburdened, aging HVAC systems. Rising temperatures, wildfires, and increased flooding will worsen ozone levels, air pollutants, airborne allergens, and mold growth, requiring HVAC systems to work harder than ever. At the same time, shifting climate trends are also accelerating the rollout of environmental regulations, driving the need for HVAC upgrades to ensure compliance.

Increased Noise Levels

The modern classroom faces a critical yet often overlooked challenge: excessive background noise. Aging HVAC systems, often one of the primary contributors to noise, can produce constant humming, vibrations, or ductwork sounds that cause distractions. This issue is amplified in aging school buildings with poor sound insulation and overcrowded classrooms. As a result, noise from mechanical equipment, combined with the natural noise of busy classrooms, makes it harder for students to focus and retain knowledge. **According to the WHO, safe noise levels in classrooms should not exceed 35 decibels, yet most classrooms operate at noise levels ranging from 50-77 decibels.**

Budget Constraints

School administrators face a dilemma when allocating their limited budgets, often being forced to choose

between immediate educational needs, teacher salaries, technology, extracurricular programs, and long-term infrastructure maintenance.

With the national investment in public school facilities falling short by \$46 billion annually (compared to \$820 billion for defense and \$4.9 trillion for healthcare investments in 2023), it is understandable why critical HVAC upgrades are often deprioritized. Historically, schools have only addressed IAQ issues reactively, typically after a crisis like discovering mold problems or witnessing spikes in student asthma rates.

This chronic underfunding sustains a costly cycle of deterioration. As HVAC systems age without proper maintenance, they become less efficient, more expensive to operate, and more likely to fail. Yet, despite clear evidence that modernizing HVAC systems leads to better outcomes, many schools remain caught in a financial bind, unable to make the necessary investments in their aging infrastructure.



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What Makes an Ideal HVAC System for Modern Schools?

Investing in modern HVAC solutions is not just about upgrading equipment; it's about creating a healthier, smarter, and more resilient future for students and educators alike.

What Makes an Ideal HVAC System for Modern Schools?

Today's HVAC systems are designed to meet the evolving challenges schools face, incorporating advanced technologies that enhance efficiency, indoor air quality (IAQ), and overall performance.

Ironically, while budget constraints often delay HVAC upgrades, modern systems actually offer cost-saving opportunities that help schools operate more sustainably in the long run. So, how do modern HVAC systems address these challenges?

FOCUS ON ENERGY EFFICIENCY

Energy-efficient HVAC solutions are a top priority for modern schools, as they can mitigate many of the challenges outlined earlier. Modern HVAC solutions achieve energy savings in multiple ways.

One key method is optimizing the mechanics of HVAC units with features like variable-speed compressors and energy recovery functions. These technologies adjust cooling output based on actual demand, running at partial capacity during low-use periods instead of the inefficient all-or-nothing approach of older systems. Many schools also utilize heat pumps, which transfer heat rather than generate it, and can reduce energy consumption for heating by up to 75% compared to electric resistance heating. Another energy-saving strategy is the implementation of decentralized HVAC systems with independent temperature zones. This design allows precise temperature control across different areas of the school, optimizing IAQ based on occupancy, space requirements, and time of day.

Together, these advancements contribute to a higher Integrated Energy Efficiency Ratio (IEER), ensuring schools maintain a comfortable learning environment while maximizing cost savings and sustainability.

What challenges does this address?

- **Budget Constraints:** Reduces operational costs through lower energy consumption and eliminating wasteful heating/cooling of unused spaces.
- **Environmental Compliance:** Meets or exceeds energy efficiency regulations.
- **Climate Resilience:** Better handles varying weather conditions with adaptive performance.
- **Noise Levels:** Allows for more distributed, quieter operation.

GREEN TECHNOLOGY

Modern HVAC systems are embracing green technology, not just as an environmental choice, but as a strategic solution. At the forefront of these innovations is heat recovery technology, which captures and reuses thermal energy from exhaust air that would otherwise be wasted. Heat pumps, in addition to being energy-efficient, are also a green cooling solution, as they use electricity to transfer heat rather than burning fossil fuels, reducing greenhouse gas emissions and improving air quality. Lastly, modern, green HVAC systems utilize eco-friendly refrigerants that are both environmentally friendly and health-friendly. Specifically, green refrigerants comply with current and potentially future environmental regulations, and they also minimize pollutants and are the least harmful to human health.

What challenges does this address?

- **Budget Constraints:** Reduces operating costs through energy recovery and efficient operation.
- **Environmental Compliance:** Meets current and anticipated environmental regulations.
- **Student Health:** Uses refrigerants that are safer for human health.

SMART TECHNOLOGY INTEGRATION

Incorporating AI technologies in almost any modern device or appliance has become an almost standard expectation, and HVAC systems for schools are no different. These advanced solutions compensate for a major drawback of traditional systems: their inability to adjust operations dynamically based on real-time environmental conditions. Modern HVAC systems utilize AI and advanced sensors to automatically optimize performance. Smart controls continuously monitor indoor and outdoor conditions, regulating heating, cooling, and ventilation as needed. This capability is empowered by self-diagnostic features that alert maintenance teams of potential issues before they escalate into problems.

What challenges does this address?

- **Budget Constraints:** Reduces energy costs by up to 25% through intelligent optimization.
- **Maintenance Burden:** Predictive maintenance prevents costly emergency repairs and avoids operational disruptions.

EASE OF MAINTENANCE

Modern HVAC systems are engineered with ease of maintenance in mind, featuring thoughtful designs that simplify cleaning and servicing. Lightweight construction and easy access to critical components ensure that routine maintenance can be completed

swiftly without interrupting daily activities or impacting the learning environment.

By keeping track of regular preventative maintenance on machines, schools can maximize their HVAC system investment in two key ways: extending the system's lifespan and reducing the workload on maintenance personnel, allowing schools to allocate resources to other critical areas.

What challenges does this address?

- **Budget Constraints:** Reduces maintenance costs and prevents expensive repairs.
- **School Disruption:** Minimizes maintenance-related interruptions.
- **System Longevity:** Extends equipment life through regular, simplified maintenance.
- **Staff Resources:** Reduces demands on maintenance personnel.

SEAMLESS INTEGRATION WITH SCHOOL LIFE

Today's HVAC solutions are designed to integrate smoothly and harmoniously into school infrastructure. For instance, a quiet operation mode ensures minimal classroom disruption, an architecturally mindful design blends seamlessly into the exterior walls of school campuses, and versatile installation options promote compatibility with each school's existing systems. Altogether, these features minimize disruption to the learning environment without compromising functionality.

What challenges does this address?

- **Budget Constraints:** Flexible installation options reduce the costs of retrofits and structural updates.
- **Noise Levels:** Quieter operation reduces classroom disruptions.

3

AIRSYS: Pioneering Educational Climate Solutions

For over three decades, AIRSYS has been a leader in the cooling industry, committed to setting standards for innovation, reliability, and efficiency. With this mindset and extensive expertise in cooling technology, we specialize in creating clean, comfortable, and quiet learning environments where the next generation can thrive.

AIRSYS: Pioneering Educational Climate Solutions

At AIRSYS, we believe that creating empowering learning environments lays the foundation for a new generation of innovators, and innovation is a core pillar in our vision.

For over three decades, AIRSYS has been a leader in the cooling industry, committed to setting standards for innovation, reliability, and efficiency. With this mindset and extensive expertise in cooling technology, we specialize in creating clean, comfortable, and quiet learning environments where the next generation can thrive.

Our innovative School Air Solutions™ are designed with a deep understanding of the unique challenges today's schools face. These insights have driven us

to develop cooling solutions that benefit both school occupants and operators. As students and staff enjoy an optimal learning environment, school operators benefit from high-quality products that address operational and budgetary challenges.

By continuously advancing our cooling technologies, we remain the preferred cooling and human comfort solution provider for K-12 campuses. Our dedication to the well-being of students and faculty is at the heart of all our School Air Solutions.



Scan to learn more about Backpack™



Backpack™

A Game-Changer in Cooling Efficiency

- Industry-leading efficiency with an IEER 40% higher than competing units.
- Built for durability with a corrosion-resistant, galvanized steel exterior.
- Compact, mindful design that seamlessly integrates with school exteriors without compromising aesthetics.

The Backpack system is a revolutionary outdoor HVAC solution designed to free up valuable indoor and ground space while maintaining top-tier performance. The Backpack is designed for maximum efficiency, from its space-saving outdoor placement to its energy-saving features like enhanced vapor injection (EVI) cooling technology and variable-speed compressors. Maintenance is just as streamlined, with versatile installation options that ensure compatibility with existing building infrastructure and convenient access to internal components for easy servicing. These elements make the Backpack a reliable, high-quality, cost-effective cooling solution for schools.



Scan to learn more about Focus IQ™



Focus IQ™

Smart Cooling for Better Learning

- Ultra-quiet mode for minimal classroom disruption and maximized student focus.
- True independent temperature control for each classroom.
- Comprehensive self-diagnostic capabilities for optimized operation and minimal maintenance disruption.

Installed indoors, the Focus IQ is designed to create a quiet, comfortable learning environment. As the quietest system in its class, it features an ultra-quiet mode that lowers sound levels by 5-7 dB.

Its use of eco-friendly R-454B refrigerant reduces greenhouse gas emissions while improving IAQ. With precise temperature control for each classroom, it can meet diverse comfort needs. These features make the Focus IQ ideal for sensitive academic settings, ensuring minimal disruption, maximizing comfort, and empowering student success.

Balancing Exceptional Cooling Performance with Long-Term Value

School operators face a critical challenge when upgrading their HVAC systems: maintaining superior IAQ while minimizing operational costs. At AIRSYS, we understand this balance and design our School Air Solutions not only to meet immediate cooling needs but to protect your investment for years to come.



SUPERIOR PRODUCT QUALITY

The true quality of a cooling system is measured through its durability, operational efficiency, reliability, and thoughtful engineering—elements that impact both immediate performance and long-term value. Our School Air Solutions embody this holistic approach to quality, combining robust construction for maximum durability, advanced efficiency features that minimize resource waste, and innovative designs that ensure consistent performance in real-world conditions. This comprehensive focus on quality translates into systems that not only perform exceptionally today but continue delivering value throughout their extended lifetime.



LONG-TERM COST EFFICIENCY

A tight budget is one of the key challenges that delays or even prevents the updating and replacement of cooling systems in schools. This is why our School Air Solutions are designed for long-term cost savings. Combining energy-efficient technologies that lower electricity costs, reliable equipment that extends system lifespan, simplified maintenance that reduces repair expenses, and the 5-year warranty that avoids costly replacements — our solutions help reduce the Total Cost of Ownership (TCO). This approach allows schools to maximize their HVAC investment while maintaining optimal performance throughout the system's life.



5-YEAR PARTS WARRANTY — UNMATCHED PROTECTION IN THE MARKET

We stand behind our commitment to quality with an industry-leading 5-year parts warranty on our School Air Solution units. This comprehensive coverage includes all original factory-installed functional parts at no additional cost, providing schools with confidence in their HVAC investment.



ENHANCED SERVICEABILITY

Maximizing the value of your HVAC system also requires proactive maintenance. To make this process as simple as possible, our School Air Solutions are designed for easy servicing. Additionally, our 24/7/365 service availability ensures that if maintenance is ever required, help is always just a call away.

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The Benefits of **Modernizing Schools' HVAC Systems**

Modernizing schools' HVAC systems is a one-time investment that delivers lasting benefits across multiple levels. Addressing it now not only resolves current challenges but also lays the foundation for future advantages down the road.

The Benefits of Modernizing Schools' HVAC Systems

Before embarking on the HVAC modernization journey, many school operators are skeptical about whether it will turn out to be beneficial or a nuisance. However, innovative, modern HVAC systems bring some tangible advantages that positively affect nearly every aspect of daily school life and behind-the-scenes operations.

IMMEDIATE BENEFITS FOR THE SCHOOL ENVIRONMENT

The impact of HVAC modernization on the school environment is immediate and profound, transforming the learning experience for students, teachers, and staff alike. Better IAQ leads to fewer respiratory issues, asthma attacks, and flu outbreaks (according to the American Lung Association, asthma is one of the leading causes of school absences, leading to an estimated 13.8 million lost school days).

Beyond the numerous health benefits, modern HVAC systems contribute to a quieter, more focused learning environment, where teachers can conduct lessons without battling background noise and students can concentrate.

The resulting improvements translate directly into tangible outcomes for the school: decreased absenteeism for both students and staff, improved learning continuity, enhanced knowledge retention, better academic outcomes, and more engaging educational learning overall.

This makes HVAC modernization a strategic move for budget-conscious school administrators. Schools that switch to efficient HVAC systems can reduce their energy consumption by up to 80%, leading to substantial annual savings.

Wisconsin's Sun Prairie Area school district exemplifies this potential, saving \$1.9 million in annual energy costs and \$15 million over 16 years through energy-efficient upgrades like ground-source heat pumps. These savings were then strategically redirected to enhance student technology resources and support teacher salaries.

Improved School Reputation

Modern HVAC systems enhance schools' reputation across multiple levels. First, by ensuring optimal IAQ and implementing systems that meet current health guidelines, schools actively demonstrate care for student well-being. Next, compliance with environmental and health regulations ensures that schools meet industry standards, demonstrating proactive leadership and dedication to maintaining a safe and sustainable learning environment. Lastly, as improved IAQ and comfort contribute to better academic performance, schools benefit from higher rankings, better test scores, and a stronger public perception, further solidifying their reputation as top-tier educational institutions and helping surrounding communities thrive.

Energy bills are schools' **SECOND-LARGEST EXPENSE** after teacher salaries.

Asthma alone accounts for an estimated

13.8m

lost school days.

BENEFITS FOR THE SCHOOL MANAGEMENT

Energy Savings

For K-12 schools, energy bills are the second-largest expense after teacher salaries, with HVAC alone accounting for about half of electricity usage.

HIGH RETURN ON INVESTMENT (ROI)

The financial return on upgrading HVAC systems is achieved through two key pathways: direct cost savings and increased funding opportunities.

On the cost-saving side, modern and environmentally-friendly HVAC systems lower energy bills, reduce maintenance costs, avoid costly repairs associated with outdated systems, and extend equipment lifespan. The result is a lower overall cost of operation in the long run. Beyond cost savings, a school's improved reputation can generate new funding streams. Parents are more likely to enroll their children in a school known for its safe and healthy environment. A strong reputation also attracts high-quality faculty and staff, reinforcing a cycle of academic excellence. Additionally, donors and businesses are more inclined to support schools that maintain a positive public image, whether through direct contributions, sponsorships, or grants.

Over time, the combined effect of reduced operational costs and increased funding opportunities can offset the initial investment in HVAC upgrades. Schools that modernize their HVAC systems ultimately create a self-sustaining cycle of financial stability and continuous improvement, ensuring a high-quality learning environment for future generations.

5

The Path to Better Education Begins with the Air We Breathe

Nearly 57.5 million students and school employees walk into schools nationwide every day. Yet, despite the sheer number of people and the countless hours spent inside these buildings, too many schools still rely on outdated infrastructure and HVAC systems. As a result, millions of students and staff spend their days breathing air filled with pollutants, compromising their health, comfort, and ability to perform at their best.

In 2016, researchers from Harvard University introduced The 9 Foundations of a Healthy Building, summarizing 30 years of scientific evidence on the critical factors influencing human health and performance. Remarkably, five of these nine factors—air quality, thermal health, moisture, noise, and ventilation—are directly tied to HVAC performance. This validation transforms HVAC upgrades from a mere infrastructure project to a strategic imperative for educational excellence.

Every school is unique, and no single HVAC solution fits all. However, one universal truth remains: modernizing HVAC infrastructure is the path forward. It's not just an expense but an investment in lasting value. By making this choice, students, faculty, and school leadership can all benefit from what we all need— a breath of fresh air.



Let's Talk!

Invest in improved indoor air quality with HVAC solutions that deliver lasting value — enhancing students' health, optimizing schools' operations, and supporting global sustainability for years to come.

Together, we can bring a breath of fresh air to school environments.



Scan to request a FREE consultation or give us a call at 855-874-5380 to learn more.

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Balance the Environment

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