LG

Ahead of the Expected

Building Better Learning Environments:

Advanced HVAC Control in Education

WHITE PAPER

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01

Introduction: The Case for Smarter HVAC in Education

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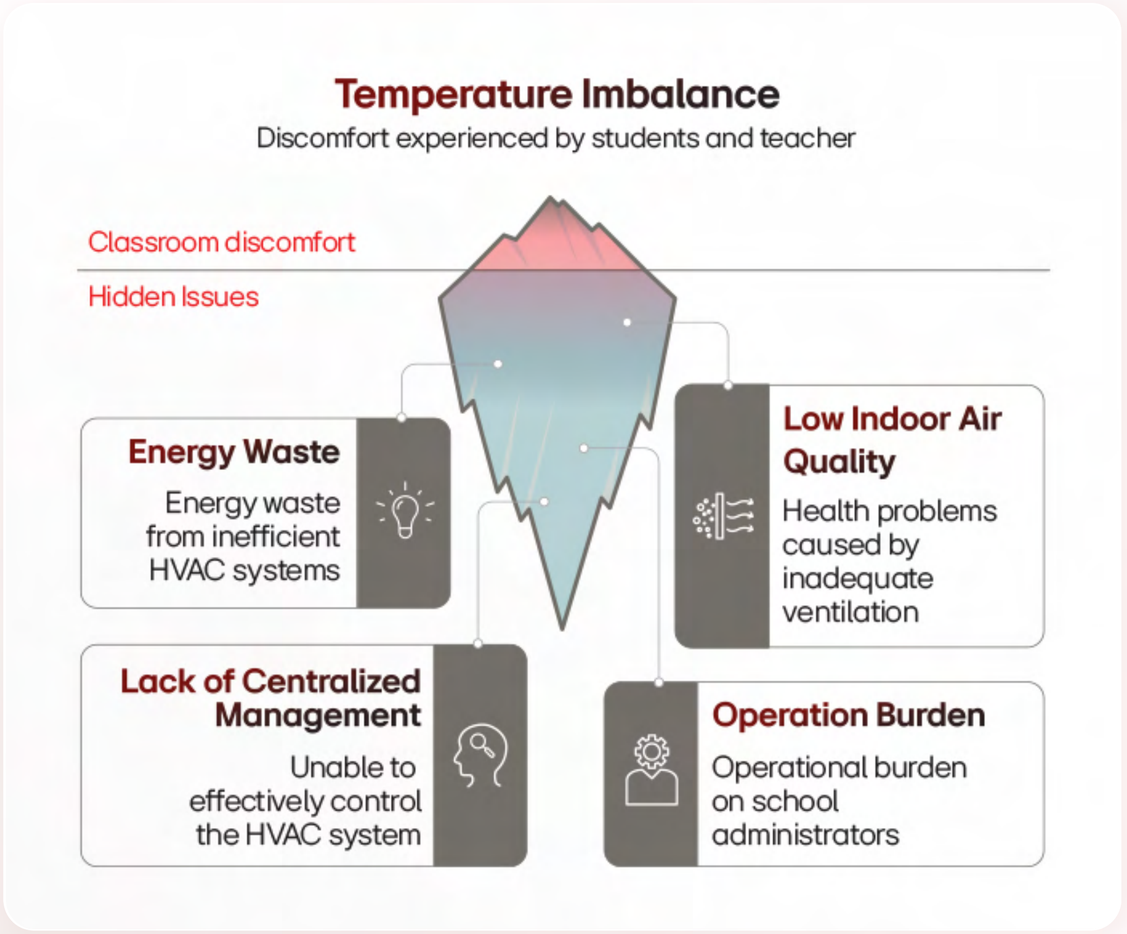

A well-managed indoor environment is now essential to modern school infrastructure. Today's educational facilities must address not only thermal comfort but also growing expectations around health, energy performance, and safety standards.

Despite these demands, many schools still operate with aging HVAC systems that lack centralized management. As a result, students and staff often experience inconsistent temperatures and poor IAQ, while energy is wasted through inefficient operation. These issues also create a heavy management burden for school personnel who may lack the necessary expertise.

Meeting these challenges requires more than a basic equipment upgrade. Schools need a smarter, integrated HVAC approach—one that can respond dynamically to changing conditions and support long-term operational goals.

This white paper explores how LG's intelligent HVAC control solutions meet these needs. By leveraging automation and centralized system management, schools can create healthier indoor environments while improving energy efficiency and easing operational strain.

02

Educational Facilities as Critical Community Infrastructure

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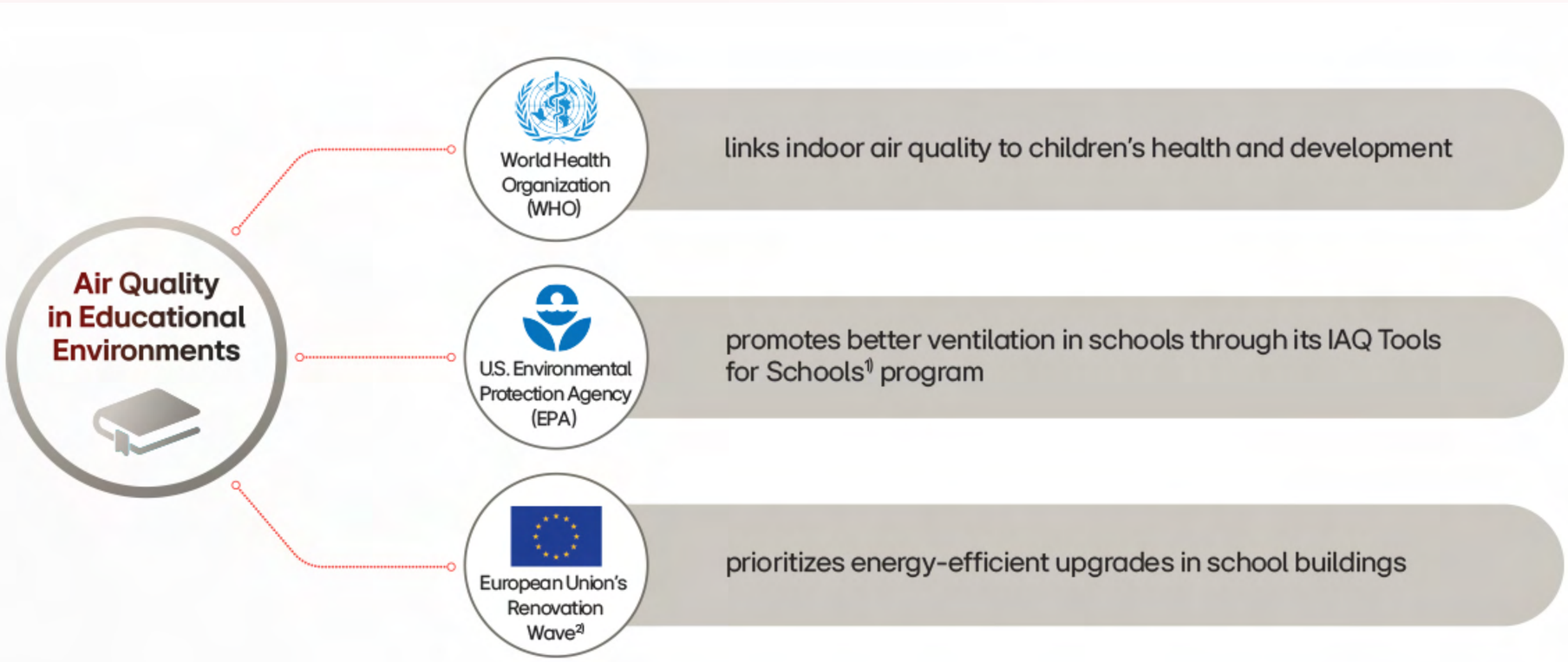
Schools play a critical role not only in education but also as key infrastructure within their communities. In addition to serving students, these facilities often act as polling stations, emergency shelters, and venues for public events. This expanded function underscores the need for safe, healthy, and adaptable environments.

Despite this importance, many schools face challenges due to aging infrastructure and underinvestment—especially in HVAC systems. Limited budgets, obsolete equipment, and inadequate system controls restrict their ability to align with modern expectations for IAQ, energy performance, and reliability.

International organizations and public policy leaders are increasingly calling for improvements in school infrastructure, recognizing that healthier and better-managed learning environments benefit not only students, but the wider community as well:

Meeting these expectations requires smarter HVAC control, not just for comfort but as a public responsibility. LG's integrated HVAC control solutions help schools fulfill this role by improving both environmental conditions and building performance.



1) https://www.epa.gov/iaq-schools
2) https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

03

Key Challenges in School HVAC Operation

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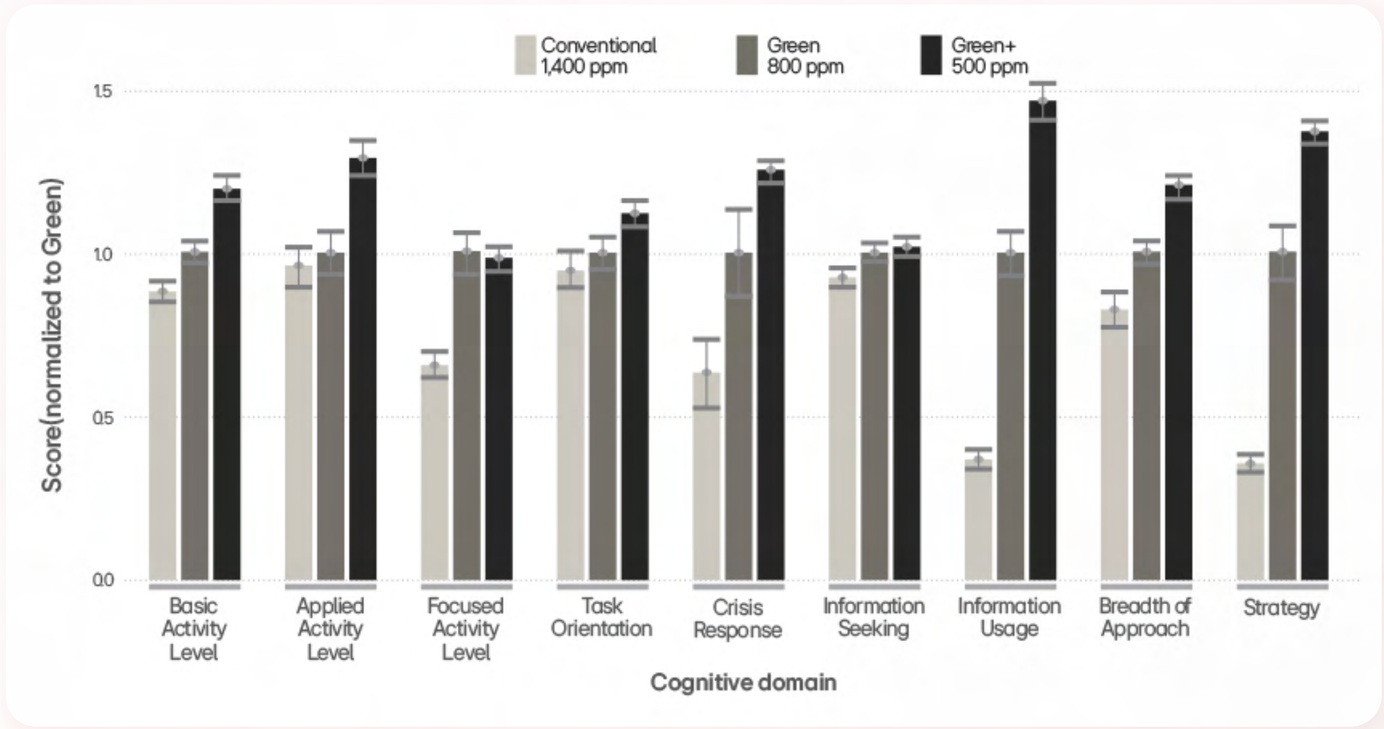
Meeting these expectations requires more than basic temperature control—it calls for intelligent HVAC solutions that support schools in their broader role as public infrastructure. Comfort, safety, and performance must be managed holistically and proactively.

LG's integrated HVAC control systems help schools meet these demands by enhancing environmental quality, improving operational efficiency, and supporting long-term building performance.

A. Indoor Air Quality Concerns

Many classrooms face ventilation challenges that lead to rapid increases in CO_2 levels, particularly during high occupancy. Studies show that elevated CO_2 concentrations can impair concentration, memory, and academic performance. At the same time, poor ventilation increases the risk of airborne virus transmission, posing health risks to students and staff. Without real-time monitoring and intelligent system response, these issues often go unnoticed until they cause discomfort or lead to health-related complaints.



* Graph of result from Harvard University study

B. Energy Waste and Operating Inefficiencies

School HVAC systems often operate outside of actual occupancy schedules—continuing to run during nights, weekends, and seasonal breaks. At the same time, students or staff frequently adjust temperature settings manually in classrooms, leading to inconsistent comfort and wasted energy. These factors make it difficult for facility managers to maintain efficient system performance.

C. Fragmented Control and Limited Oversight

Many schools operate across multiple buildings or campuses, each with independent HVAC systems. Without centralized control, facility managers lack visibility into overall system performance. This fragmented setup delays the detection of issues and hinders timely response, increasing the risk of equipment downtime and adding to operational stress.

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LG’s Integrated Control Solutions for Solving School HVAC Challenges

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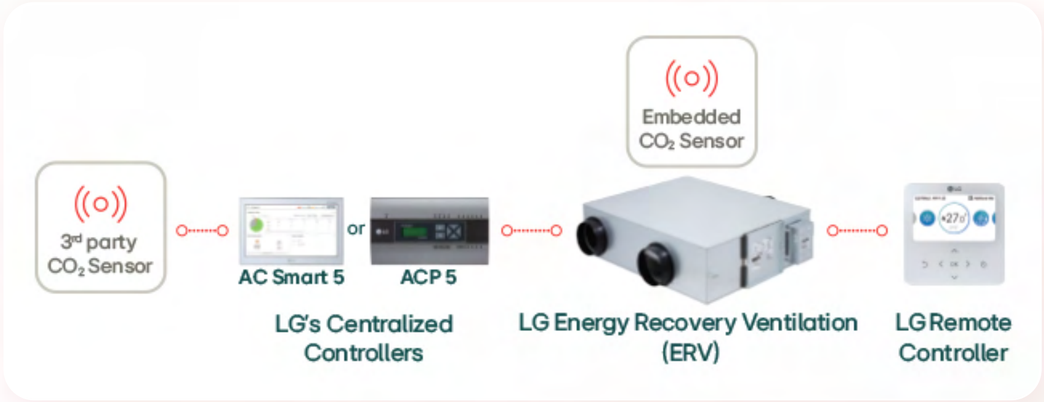
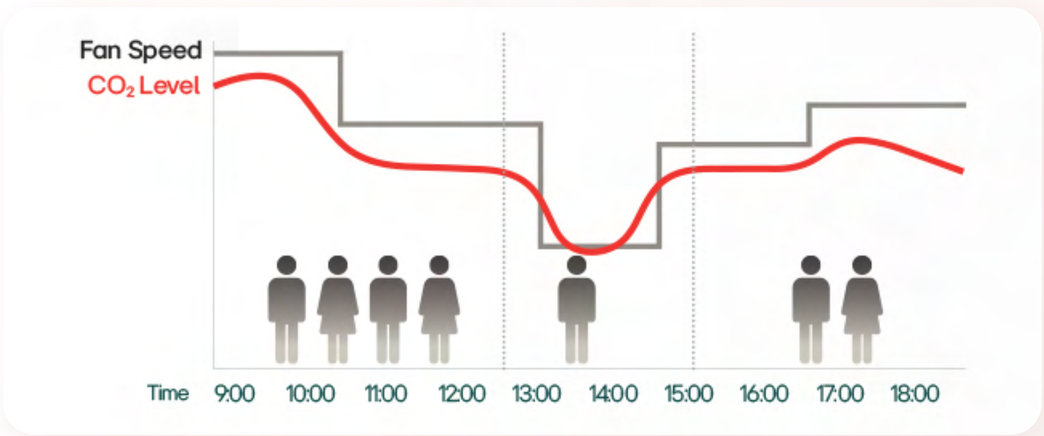
A. Creating a Healthy Learning Environment

Maintaining clean and well-ventilated air in classrooms is essential to support cognitive performance and protect student health. LG's integrated HVAC control solutions play a critical role in achieving this.

i. Real-Time CO_2 Monitoring and Automated Ventilation

LG's Energy Recovery Ventilation (ERV) systems include built-in CO_2 sensors that continuously monitor indoor air quality. When CO_2 levels rise above a preset threshold, the system automatically increases fan speed to enhance ventilation and ensure proper air exchange. These CO_2 levels can be viewed directly on individual room controllers. For added flexibility, third-party CO_2 sensors can also be integrated using LG's AC Smart 5 or ACP 5 systems, allowing customized ventilation control based on site-specific sensor placement and user-defined CO_2 targets.

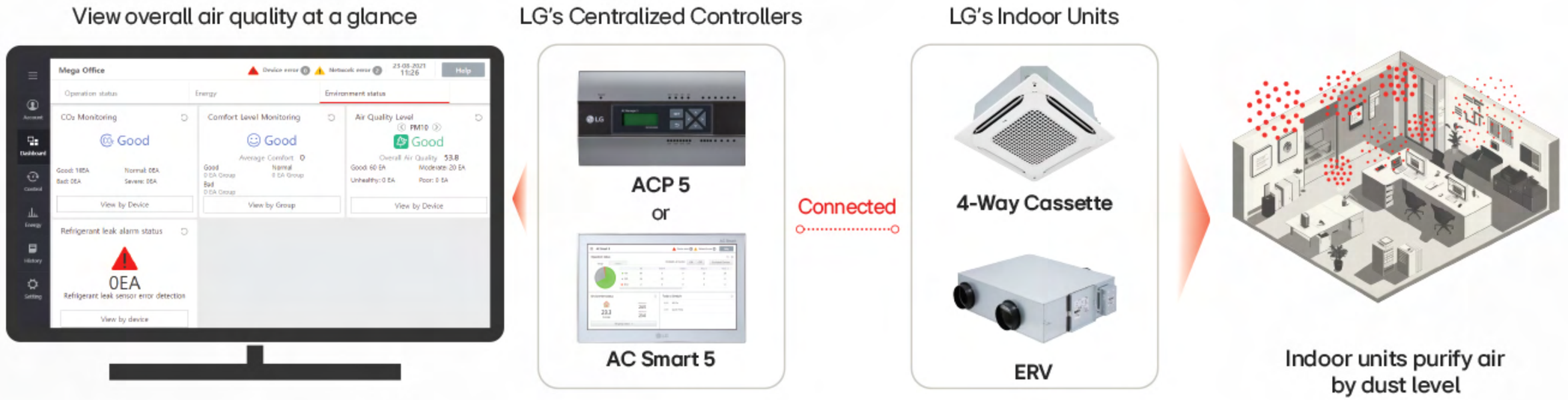




ii. Air Quality-Driven Alerts and Interlocking Controls

LG's centralized controllers, ACP 5 and AC Smart 5, enable interlocking control based on air quality inputs such as fine dust levels. When connected to indoor units equipped with air purification filters and fine dust detection sensors, the system can perform various air purification actions in response to measured fine dust values. For example, it can activate the ERV system, adjust indoor unit operation modes, or send alert emails to facility managers when thresholds are exceeded.

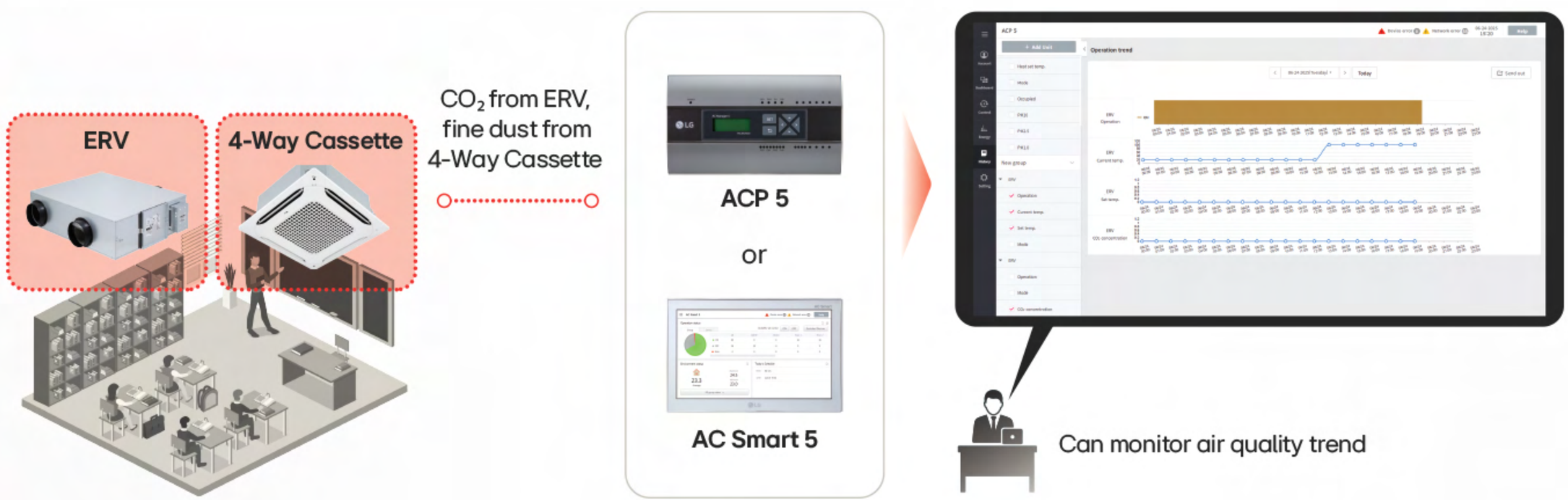
Additionally, the centralized controller offers a comprehensive overview of air quality across the facility, while the filter replacement alarm supports convenient long-term maintenance.



iii. Data Logging for Analysis and Compliance

CO_2 data from the ERV and fine dust measurements from indoor units are continuously logged in the centralized controller, allowing schools to visualize air quality trends, verify compliance with standards, and support regulatory reporting requirements.

These functions work together to provide a consistently healthy and comfortable indoor environment, enhancing both student focus and well-being.

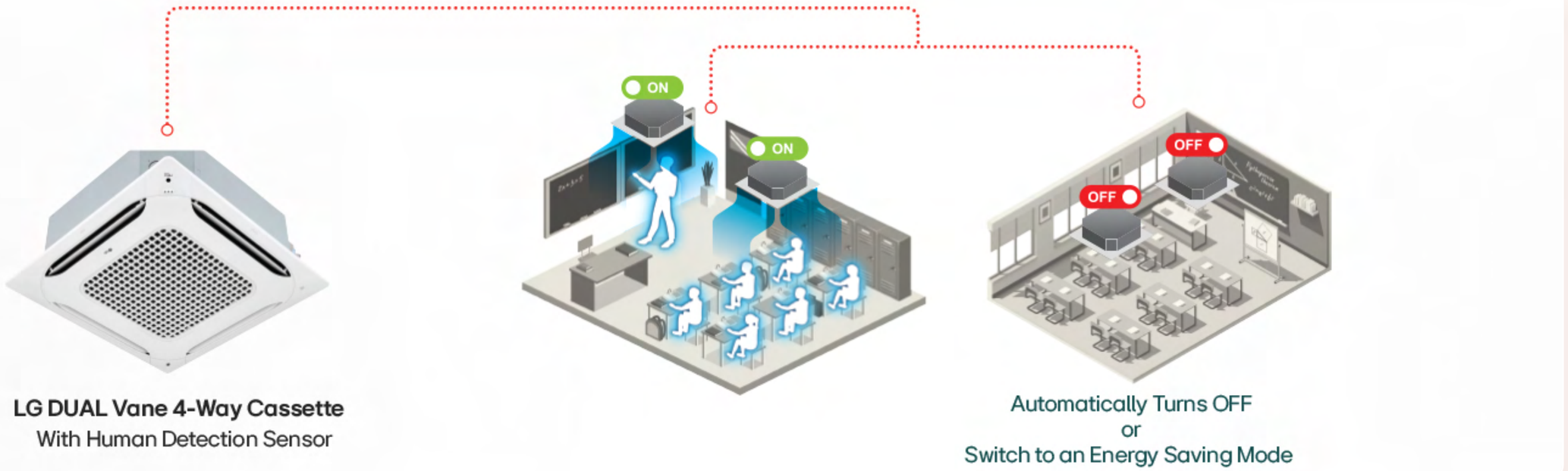


B. Reducing Energy Waste through Smarter Operation

Many schools lose energy by relying on fixed operation or manual HVAC settings that don't reflect real-time occupancy. LG's intelligent control solutions help overcome this inefficiency through scheduled operation, real-time energy monitoring, and exception-based system adjustments.

i. Occupancy-Based Automation

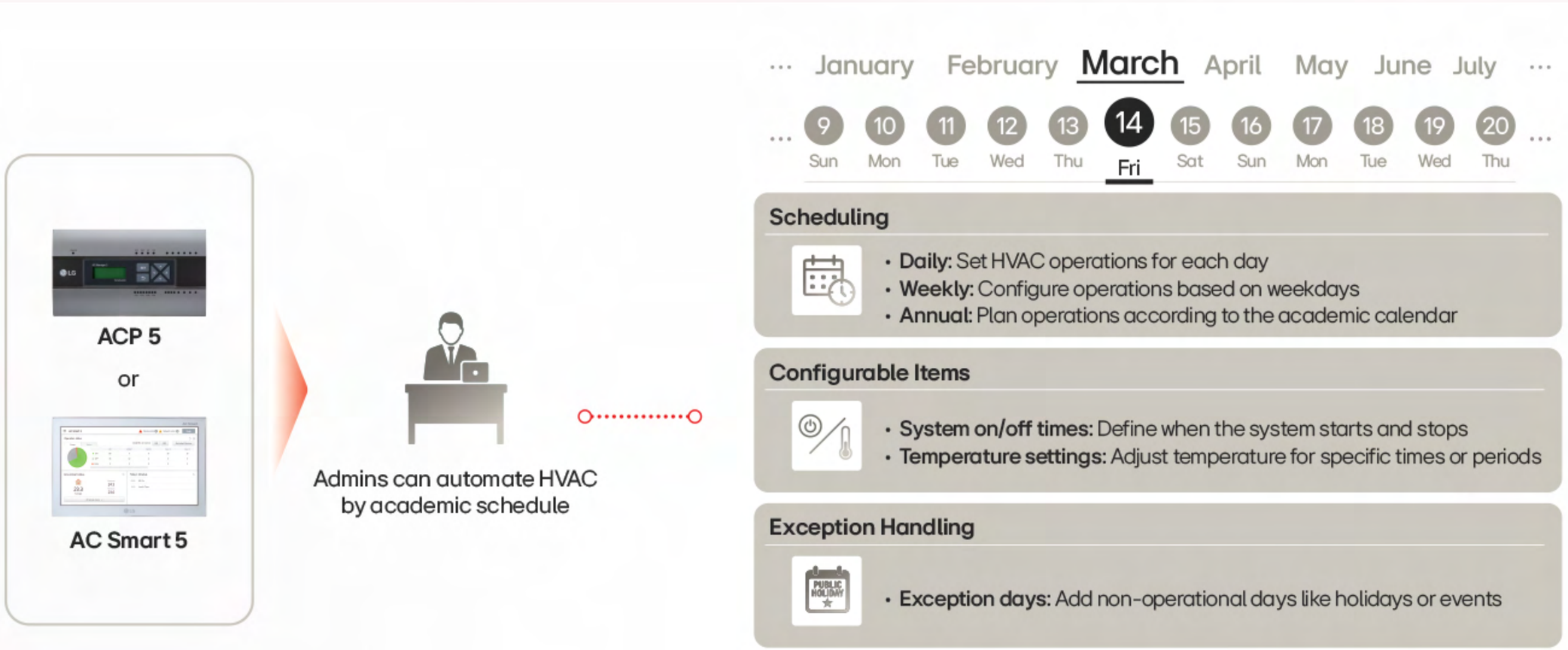
When an indoor unit[1)] is equipped with a human detection sensor, it can optimize energy use by adjusting operation based on occupancy. If no presence is detected for a set period, the system automatically turns off or switches to an energy-saving mode, achieving power savings



1) Available in DUAL Vane 4-Way Cassette

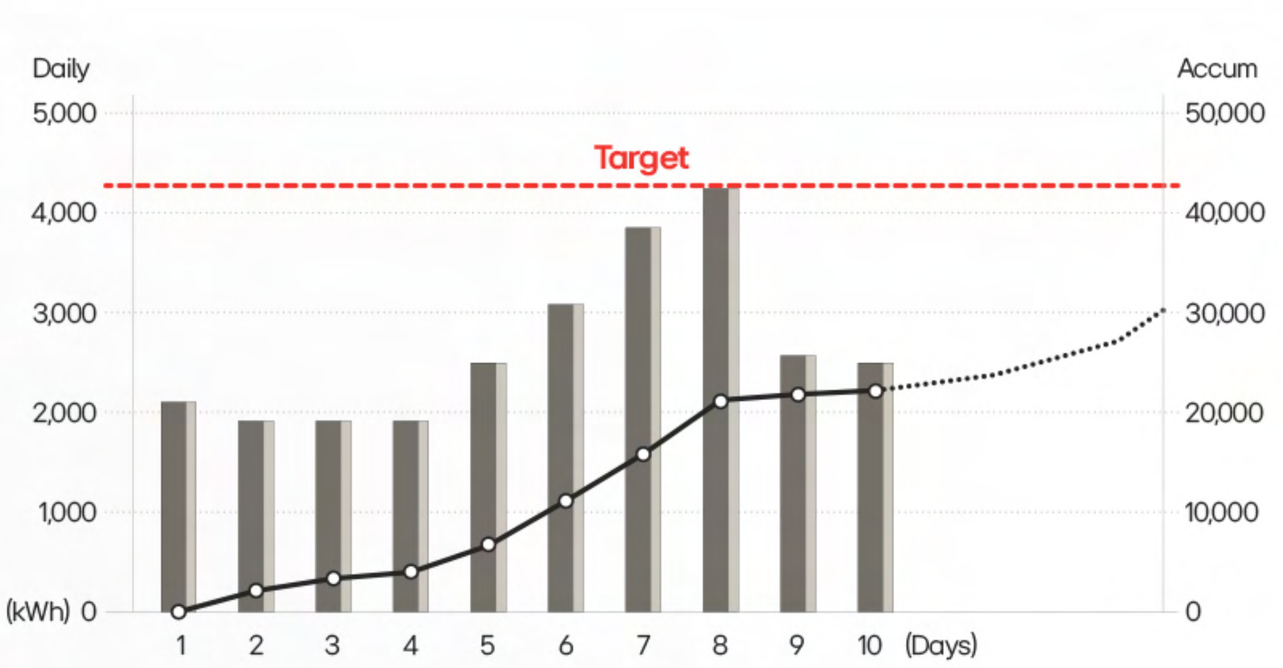
ii. Schedule-Based HVAC Operation

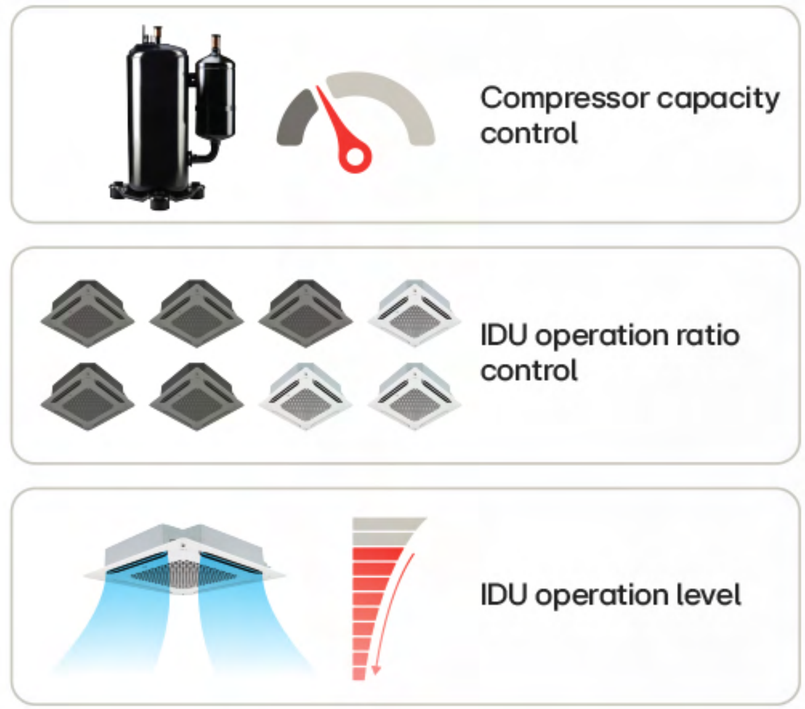
LG's ACP 5 and AC Smart 5 controllers allow administrators to automate HVAC operations in line with academic calendars, supporting daily, weekly, and annual scheduling. System on/off times and temperature settings can be customized to match actual school hours, while exception days—such as holidays or special events—can be defined to avoid unnecessary system operation.



iii. Energy Navigation for Optimal Consumption

The Energy Navigation function enables air conditioners to set monthly energy usage targets based on historical consumption data. By comparing real-time usage trends with preset targets, the system can automatically adjust compressor output and indoor unit operation levels to prevent excess energy use and maintain optimal efficiency.

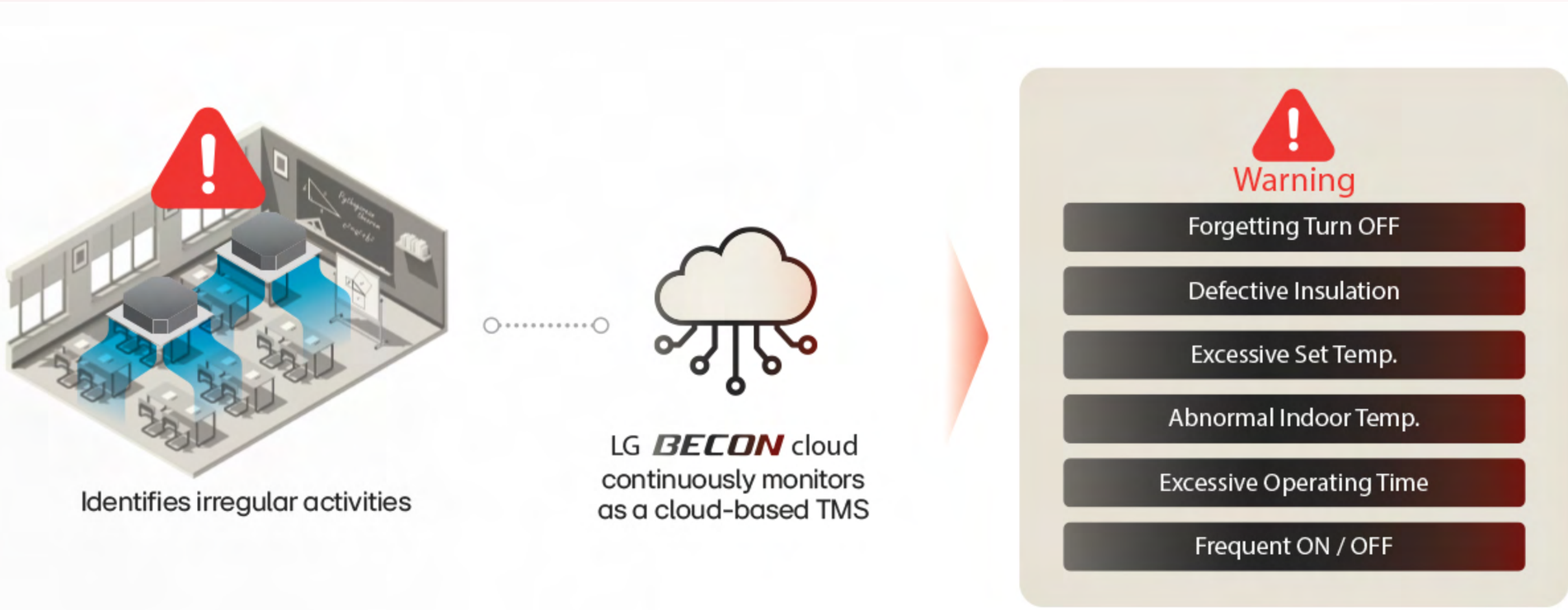




iv. Detection of Abnormal Energy Usage

LG BECON cloud, a cloud-based Total Maintenance Service (TMS), continuously monitors HVAC usage patterns and identifies irregular activities, such as operation during holidays or extreme temperature settings. It provides timely alerts to facility managers, enabling proactive measures to reduce energy waste and maintain efficient system performance.

By aligning HVAC operations with real-world usage, these controls significantly reduce wasted energy while ensuring classrooms remain comfortable and cost-efficient.

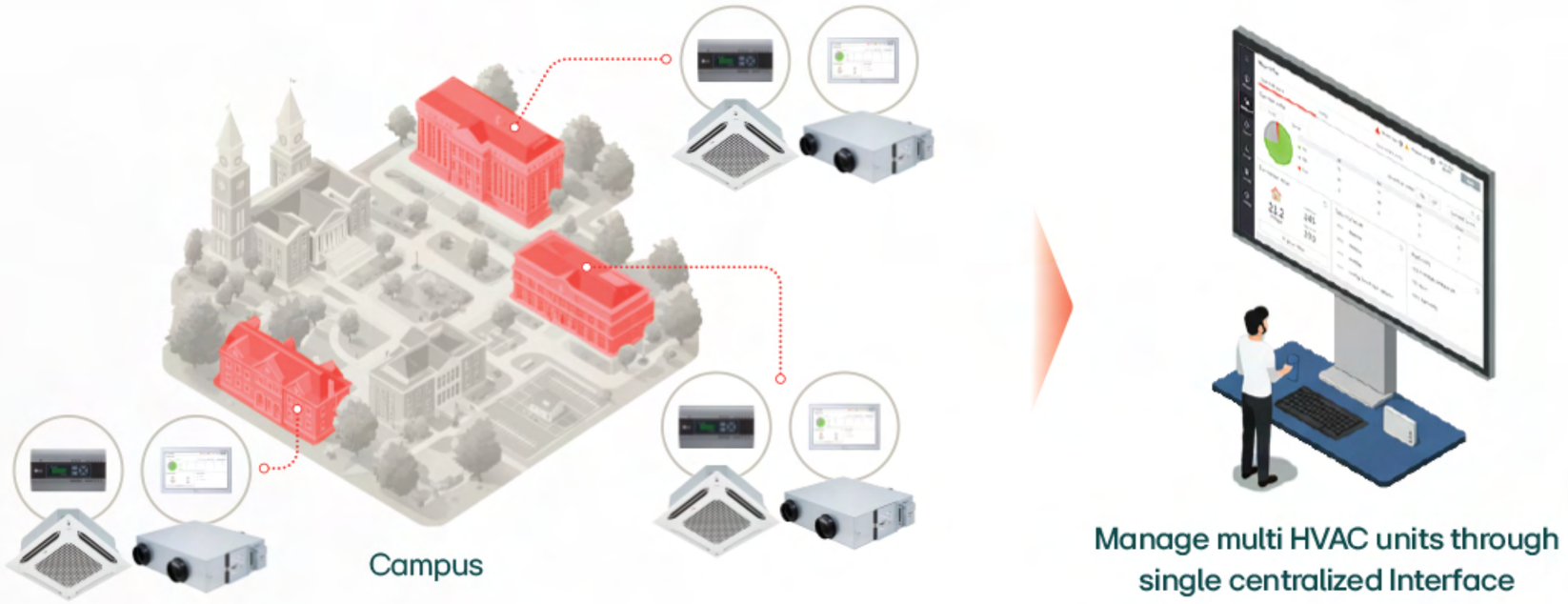


C. Improving Operational Management and Maintenance

Effective facility management goes beyond automation—it depends on centralized visibility and timely, proactive response. LG's control solutions equip school administrators with robust tools to optimize operations, minimize downtime, and maintain consistent performance.

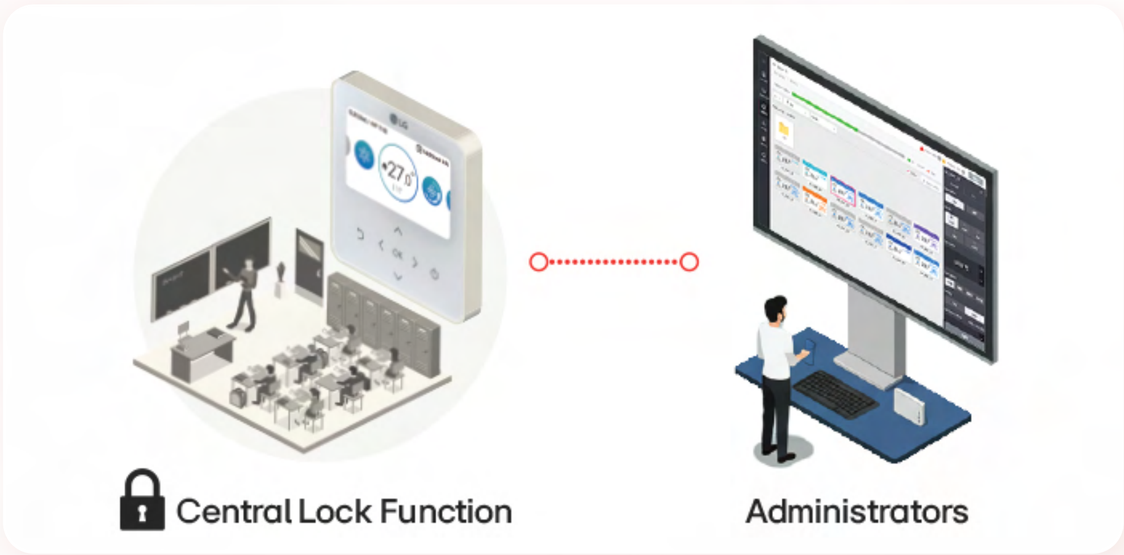
i. Centralized HVAC Management

LG's ACP 5 and AC Smart 5 systems allow administrators to manage multiple HVAC units across different buildings through a single, centralized interface. This unified control helps schools ensure consistent comfort, streamline operations, and optimize performance across entire campuses.



ii. Prevention of Unauthorized Control

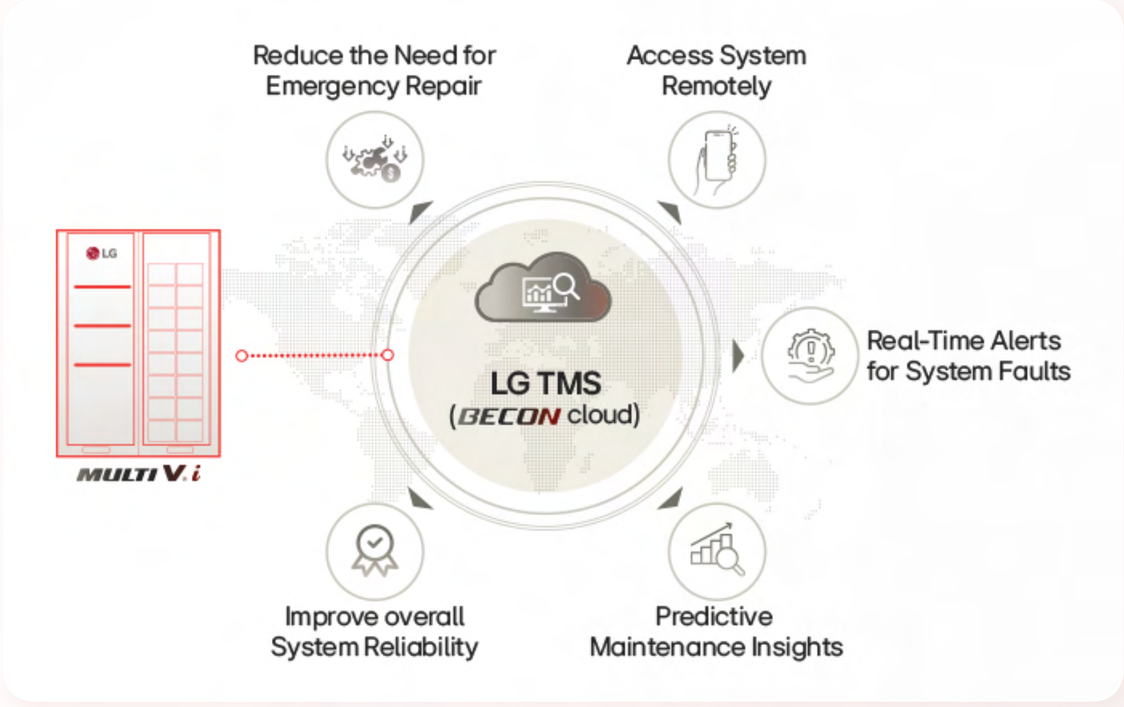
To ensure consistent settings and prevent energy waste, administrators can use central lock functions to restrict manual temperature changes in classrooms, especially by students or non-authorized staff.



iii. Remote Monitoring and Predictive Maintenance

LG BECON cloud provides remote access, real-time fault alerts, and predictive maintenance insights. These capabilities enable facility managers to detect potential issues early, enhance system reliability, and reduce the need for emergency repairs.

These tools work together to simplify HVAC management, helping schools maintain high operational standards with fewer resources.



05
Conclusion

Indoor environmental quality is essential to protecting student health and supporting academic performance. Yet many schools continue to rely on outdated or fragmented HVAC systems, making it difficult to meet today's expectations for air quality, energy efficiency, and operational reliability.

LG's integrated control solutions offer a clear and practical response to these challenges. With real-time monitoring, centralized management, and intelligent automation, schools can improve indoor conditions while reducing operational costs. Upgrading HVAC controls is not just a technical enhancement—it's a strategic investment in creating learning environments that are more efficient, resilient, and ready for the future.

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