If a genie granted you one wish, how would you make school facilities better?

NOTE: You can't say "more money" or ask for more wishes.

https://www.menti.com/al6mao2bhqex

ASSOCIATION FOR LEARNING ENVIRONMENTS

CHICAGO

LearningSCAPES 2023

High Performance Schools:

The answer to your school facilities questions.

How do we make schools better for **all** students?

Introductions

CRAIG SCHILLER
Executive Director
CHPS

AARON JOBSON
President/CEO
Quattrocchi Kwok
Architects

IRENE NIGAGLIONI
President
IN2 Architecture

Mission

We aspire to make every school an ideal place to learn.

For 20 years, CHPS has developed and maintained the nation's only third-party building standard explicitly designed by K12 schools and focused on improving student performance.

Priorities:

- Increase student performance and health of students & staff
- Reduce operating costs through better design
- Enhance environmental stewardship

Abbott Downing, Concord NH (NE-CHPS)

CHPS Impact

- Over 750 CHPS projects nationwide
- 70+ school districts have used CHPS
- 4 of top 20 largest school districts require CHPS:
  - *Los Angeles USD, CA (#2)*
  - *Fairfax County Public Schools, VA (#11)*
  - *Dallas ISD, TX (#16)*
  - *Cypress-Fairbanks ISD, TX (#21)*
- Rhode Island requires CHPS
- Massachusetts & Colorado provide state funding to CHPS schools
- Washington used CHPS as the basis for their required Washington Sustainable Schools Protocol (WSSP)

US-CHPS Overview, based on v2.0

- 250 points total; 52 for prerequisites
- 7 Sections:
  - Integration & Innovation: 2 prereqs, 7 credits, 35 points, includes climate action
  - Indoor Environmental Quality: 5 prereqs, 15 credits, 81 points
  - Energy: 2 prereqs, 3 credits, 20 points
  - Water: 2 prereqs, 6 credits, 20 points
  - Site: 1 prereq, 7 credits, 23 points, includes exterior measures
  - Materials and Waste Management: 1 prereq, 5 credits, 16 points
  - Operations and Maintenance: 2 prereqs, 5 credits, 18 points

Agenda

1. Why do High Performance Schools Matter?
2. How do we achieve High Performance Schools?
3. How do we deliver these results?

Historical Approach

- Set an example with highest performing schools
- Prove that sustainable, High-Performance Schools are possible
- Focus on new schools and major renovations
- Has made significant impact
- Implemented primarily (but not exclusively) in higher income areas that can afford more investment

Expanded Focus

- Make CHPS criteria and resources applicable to all projects
- Help all schools improve the quality of their facilities
- Reduce barriers to entry for Districts, Design Teams and Communities
- Make CHPS an effective tool to improve every facilities decision
- Continue to implement new strategies to raise the ceiling

What are some components of High Performance Schools?

https://www.menti.com/al6mao2bhqex

High Performance Schools

Student Performance and Health

Conserve Resources

Protect the Environment

Cupertino High School

High Performance Schools

Student Performance and Health

- ❑ Daylighting & Lighting
- ❑ Air Quality
- ❑ Acoustics & Thermal Comfort
- ❑ Wellness
- ❑ Variety
- ❑ Flexibility
- ❑ Adaptability

Cypress-Fairbanks ISD

High Performance Schools

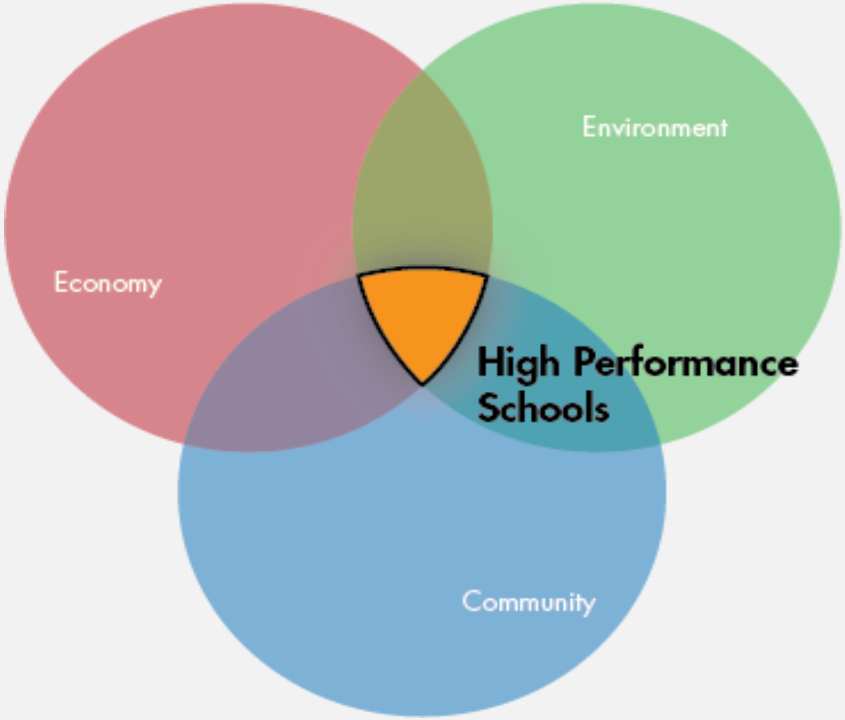
Conserve Resources

Protect the Environment

- ❑ Energy Usage
- ❑ Increase Renewable Use
- ❑ Water Conservation
- ❑ Site Development

Elk Grove USD

High Performance Schools



R.O.E. =
Return on Environment

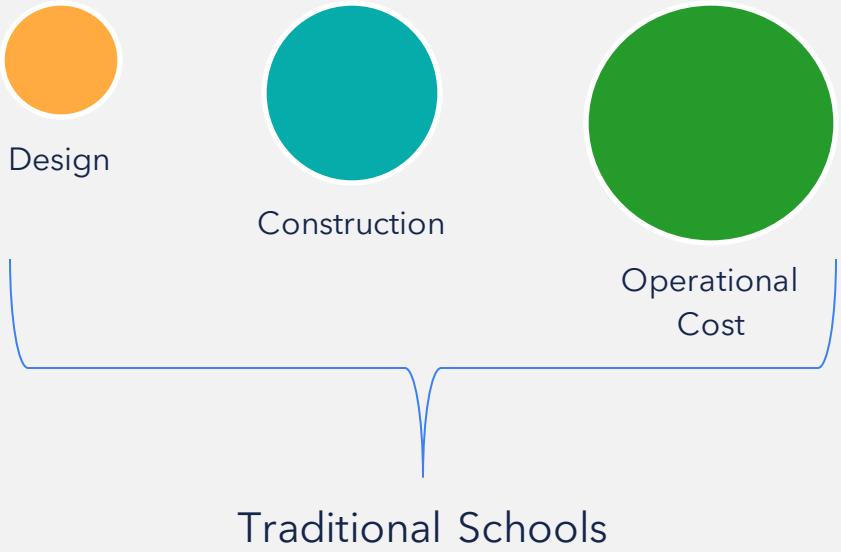
Impact of High Performance Schools

High Performance Schools Can:

- ✓ Reduce absenteeism with healthier learning environments.
- ✓ Improve student performance and provide educational opportunities.
- ✓ Enhance Student/Teacher learning/teaching productivity.
- ✓ Reduce operating costs.
- ✓ Lower environmental impact and reduce carbon emissions.

Impact of High Performance Schools

Total Cost of Ownership (TCO)



Impact of High Performance Schools

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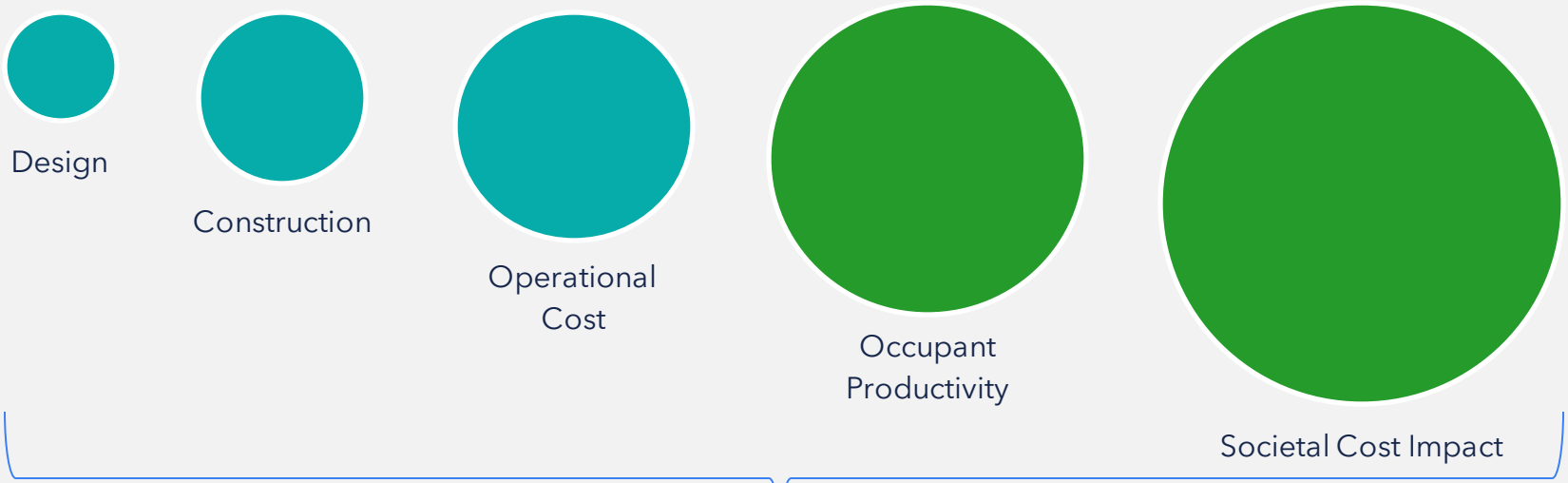


The Problem

- US school infrastructure has received a D+ grade or lower from the ASCE since 1988
- There are >130,000 K-12 public schools in the US and most of them are >50 years old, in desperate need of repair/modernization
- Students from low-income, minority and rural families are most likely to attend underfunded school facilities

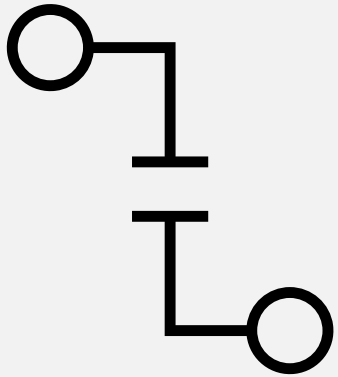
- ➢ >53% of districts report the need to update or replace multiple building systems
- ➢ The majority of districts' facility expenditures go toward school building renovations

What components of High-Performance Schools is most in need in your community?

https://www.menti.com/al6mao2bhqex

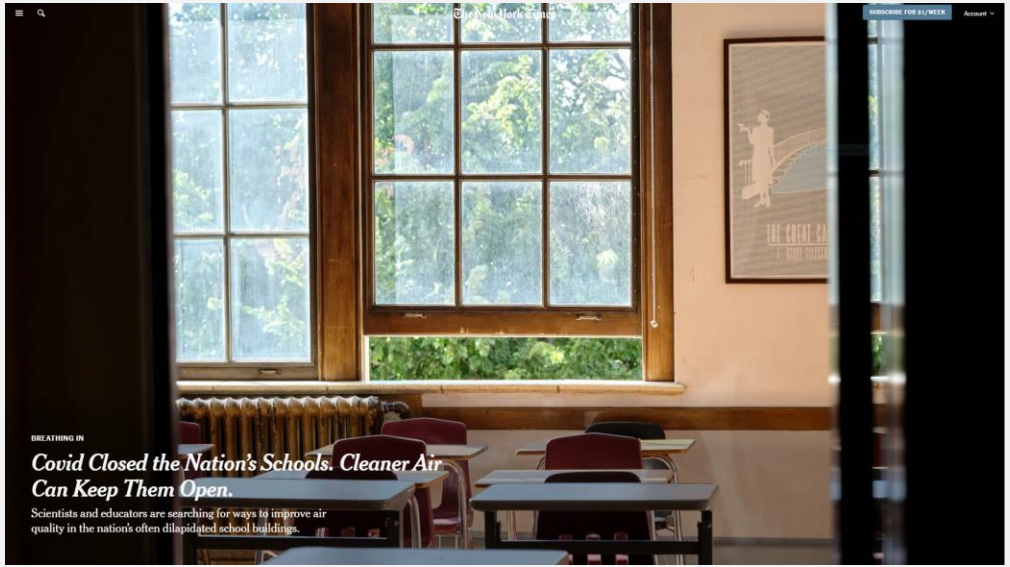
The Disconnects

- Facility improvement needs of existing schools
- School districts bond programs
- Utility rebate incentives
- Federal funding opportunities
- Lack of project accountability for Energy Savings Performance Contracts
- Districts often rely on for-profit companies telling them what's best



"Schoolchildren are heading back to classrooms by the tens of millions now, yet much of the funding for such improvements is sitting untouched in most states.

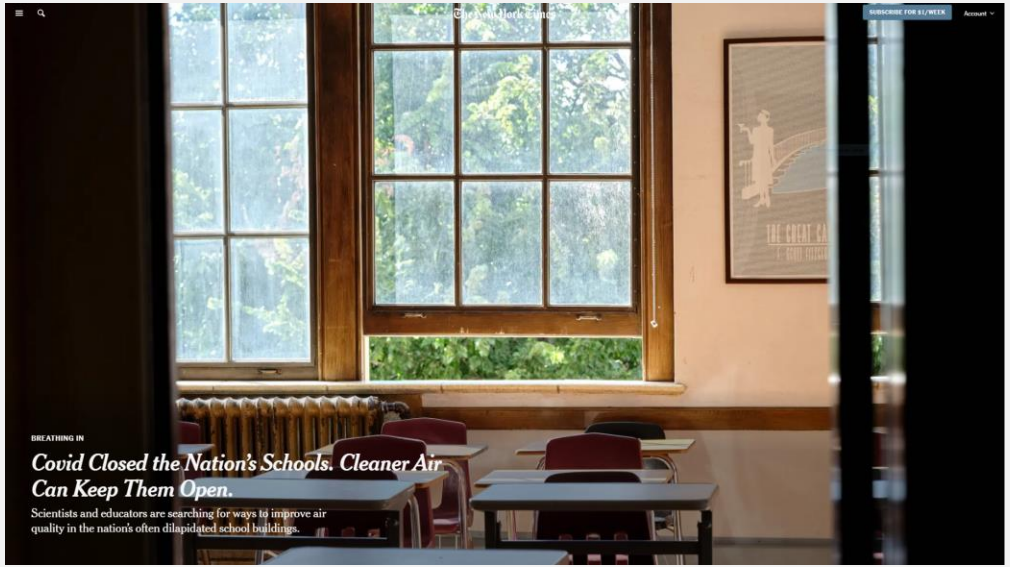
Among the reasons: a lack of clear federal guidance on cleaning indoor air, no senior administration official designated to oversee such a campaign, few experts to help the schools spend the funds wisely, supply chain delays for new equipment, and insufficient staff to maintain improvements that are made."



"…the incidence of COVID was about 40% lower in schools that improved air quality…"

Indoor air quality can also be a problem from a variety of other sources such as smoke, carbon monoxide, and pollution causing asthma and other chronic illness and contributing to absenteeism.

"…decades of research have suggested that improving air quality also can raise academic performance, increase test scores, bolster attention and memory, and decrease absences…"



“Still, urban schools must juggle a host of competing priorities, including the safety, mental health and achievement of students. Air quality can seem less urgent. Even in the times of Covid, there were things that were higher on the list for people than that,” Terita Walker, the principal of East High, said.

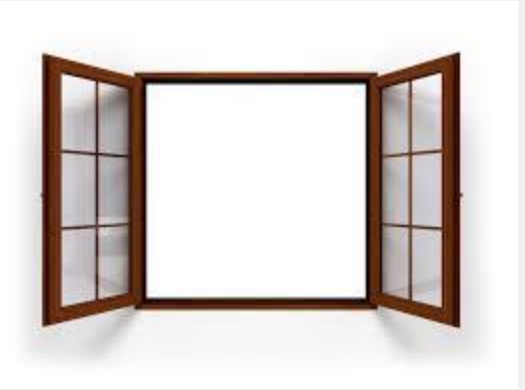
Terita Walker, the principal of East High, must juggle a number of priorities, including students' safety and academic achievement. Stephen Speranza for The New York Times

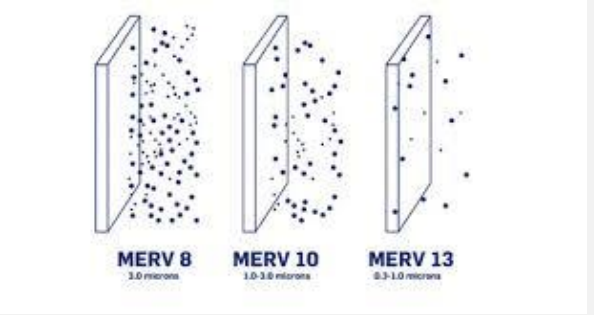
“You’re asking school districts and facilities that really don’t understand the sort of fundamentals and mechanical systems to make decisions,” said Richard Corsi, Dean of the College of Engineering at University of California, Davis. “It’s difficult for them.”

The Magic School Bus

I want to improve air quality in my schools!

Valerie Frizzle, Superintendent,
Walkerville Elementary School District





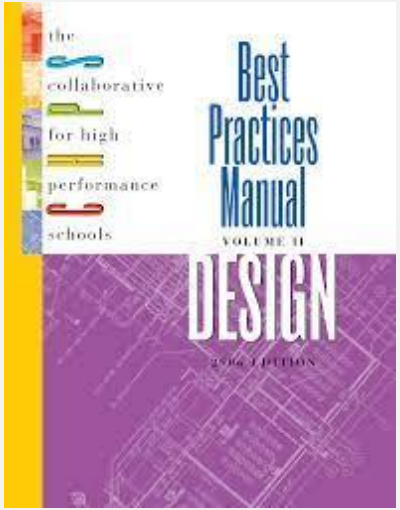
I want to improve air quality in my schools!

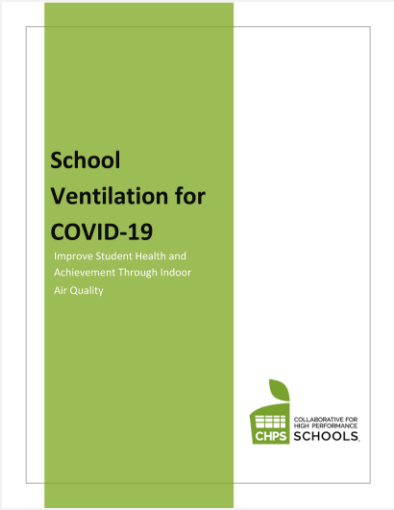
Valerie Frizzle, Superintendent,
Walkerville Elementary School District

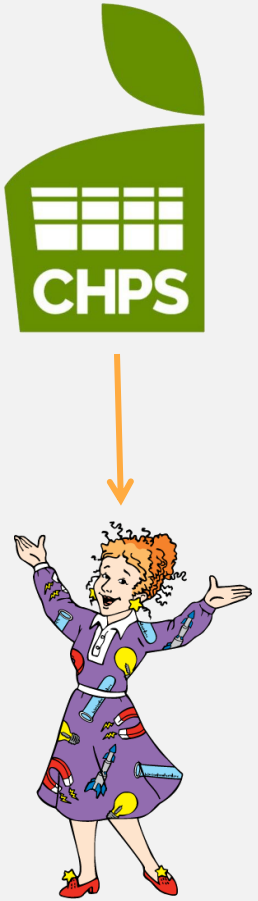
- What is the best thing to do?
- How much will it cost?
- What impact will it have on student health?
- How will we maintain it?
- How do I make sure the improvements will work and benefit students?
- Who can I trust?
- How can I convince my Board and Community this is the right thing to do?
- How can I be sure we are using best practices?
- Where do we get started?

How can CHPS help?

Best Practices Resources:

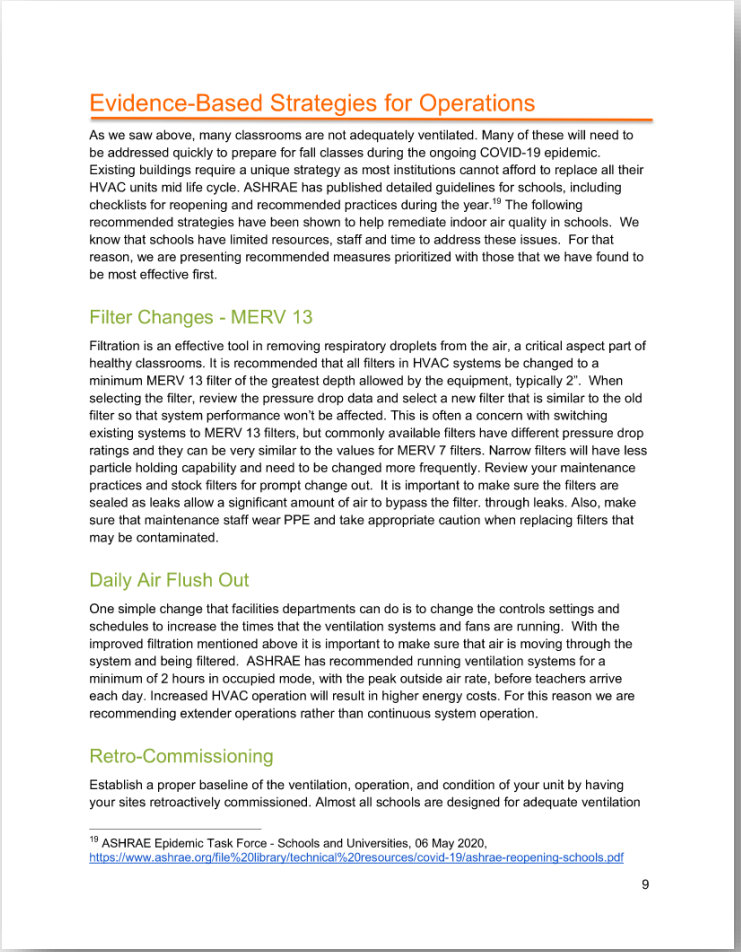






Whitepaper:

- Summary of background science and why air quality is important
- Recommended strategies for Operations that can be implemented immediately
- Evidence based strategies for Renovations and New Buildings
- Recommended project requirements to help with implementation
- References CHPS Criteria



Evidence-Based Strategies for Operations

As we saw above, many classrooms are not adequately ventilated. Many of these will need to be addressed quickly to prepare for fall classes during the ongoing COVID-19 epidemic. Existing buildings require a unique strategy as most institutions cannot afford to replace all their HVAC units mid life cycle. ASHRAE has published detailed guidelines for schools, including checklists for reopening and recommended practices during the year.[19] The following recommended strategies have been shown to help remediate indoor air quality in schools. We know that schools have limited resources, staff and time to address these issues. For that reason, we are presenting recommended measures prioritized with those that we have found to be most effective first.

Filter Changes - MERV 13

Filtration is an effective tool in removing respiratory droplets from the air, a critical aspect part of healthy classrooms. It is recommended that all filters in HVAC systems be changed to a minimum MERV 13 filter of the greatest depth allowed by the equipment, typically 2". When selecting the filter, review the pressure drop data and select a new filter that is similar to the old filter so that system performance won't be affected. This is often a concern with switching existing systems to MERV 13 filters, but commonly available filters have different pressure drop ratings and they can be very similar to the values for MERV 7 filters. Narrow filters will have less particle holding capability and need to be changed more frequently. Review your maintenance practices and stock filters for prompt change out. It is important to make sure the filters are sealed as leaks allow a significant amount of air to bypass the filter. through leaks. Also, make sure that maintenance staff wear PPE and take appropriate caution when replacing filters that may be contaminated.

Daily Air Flush Out

One simple change that facilities departments can do is to change the controls settings and schedules to increase the times that the ventilation systems and fans are running. With the improved filtration mentioned above it is important to make sure that air is moving through the system and being filtered. ASHRAE has recommended running ventilation systems for a minimum of 2 hours in occupied mode, with the peak outside air rate, before teachers arrive each day. Increased HVAC operation will result in higher energy costs. For this reason we are recommending extender operations rather than continuous system operation.

Retro-Commissioning

Establish a proper baseline of the ventilation, operation, and condition of your unit by having your sites retroactively commissioned. Almost all schools are designed for adequate ventilation

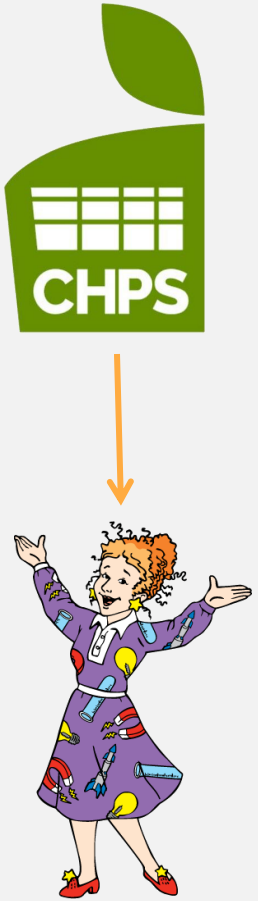
[19] ASHRAE Epidemic Task Force - Schools and Universities, 06 May 2020, https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-reopening-schools.pdf

9

How can CHPS help?

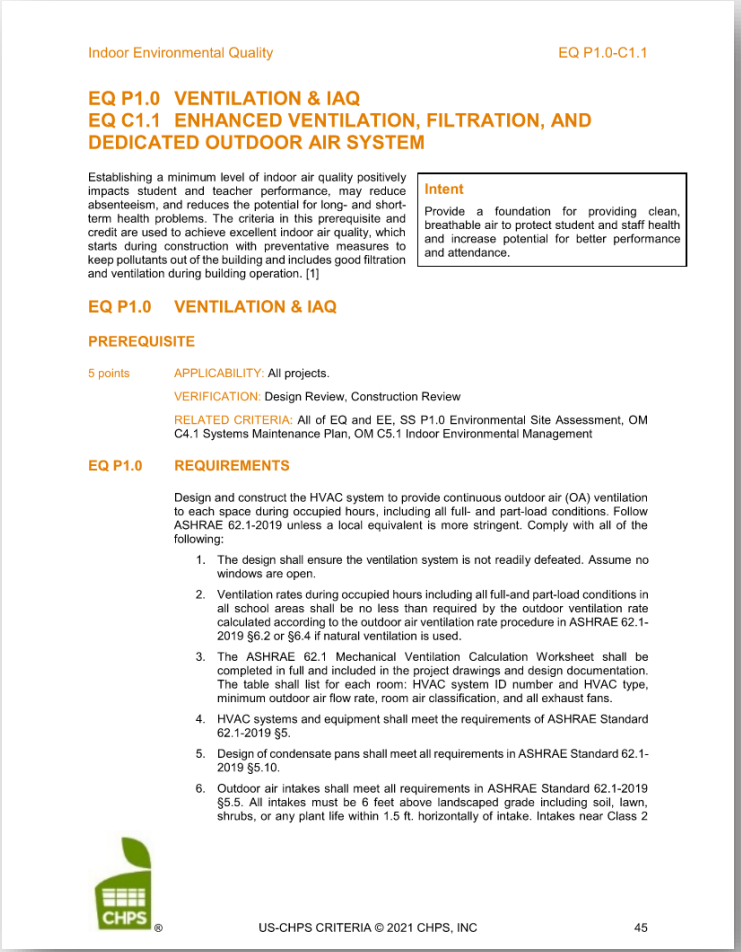
Technical Standards and Design Criteria:

- EQ P1.0 – Ventilation and IAQ
- EQ C1.1 - Enhanced Ventilation, Filtration and Dedicated Outdoor Air Systems
- EQ C1.2 – Demand Controlled Ventilation
- EQ P10.0 – Thermal Comfort
- EQ P15.0 – Acoustical Performance
- EE P1.0 – Energy Efficient Design
- EE C4.1 – Advanced Ventilation Strategies
- OM P1.0 – Facility Staff and Occupant Training
- OM C5.1 – Indoor Environmental Management



Requirements:

- Detailed technical requirements
- Evidence and research based
- Developed and refined over 20+ Years for school projects
- Reviewed and updated by a national technical committee
- References broadly recognized industry standards



EQ P1.0 VENTILATION & IAQ
EQ C1.1 ENHANCED VENTILATION, FILTRATION, AND DEDICATED OUTDOOR AIR SYSTEM

Establishing a minimum level of indoor air quality positively impacts student and teacher performance, may reduce absenteeism, and reduces the potential for long- and short-term health problems. The criteria in this prerequisite and credit are used to achieve excellent indoor air quality, which starts during construction with preventative measures to keep pollutants out of the building and includes good filtration and ventilation during building operation. [1]

Intent

Provide a foundation for providing clean, breathable air to protect student and staff health and increase potential for better performance and attendance.

EQ P1.0 VENTILATION & IAQ

PREREQUISITE

5 points

APPLICABILITY: All projects.

VERIFICATION: Design Review, Construction Review

RELATED CRITERIA: All of EQ and EE, SS P1.0 Environmental Site Assessment, OM C4.1 Systems Maintenance Plan, OM C5.1 Indoor Environmental Management

EQ P1.0 REQUIREMENTS

Design and construct the HVAC system to provide continuous outdoor air (OA) ventilation to each space during occupied hours, including all full- and part-load conditions. Follow ASHRAE 62.1-2019 unless a local equivalent is more stringent. Comply with all of the following:

1. The design shall ensure the ventilation system is not readily defeated. Assume no windows are open.
2. Ventilation rates during occupied hours including all full-and part-load conditions in all school areas shall be no less than required by the outdoor ventilation rate calculated according to the outdoor air ventilation rate procedure in ASHRAE 62.1-2019 §6.2 or §6.4 if natural ventilation is used.
3. The ASHRAE 62.1 Mechanical Ventilation Calculation Worksheet shall be completed in full and included in the project drawings and design documentation. The table shall list for each room: HVAC system ID number and HVAC type, minimum outdoor air flow rate, room air classification, and all exhaust fans.
4. HVAC systems and equipment shall meet the requirements of ASHRAE Standard 62.1-2019 §5.
5. Design of condensate pans shall meet all requirements in ASHRAE Standard 62.1-2019 §5.10.
6. Outdoor air intakes shall meet all requirements in ASHRAE Standard 62.1-2019 §5.5. All intakes must be 6 feet above landscaped grade including soil, lawn, shrubs, or any plant life within 1.5 ft. horizontally of intake. Intakes near Class 2

Implementation:

- Detailed requirements for what needs to be addressed throughout design and construction process
- Describes research-based rationale for why these requirements are important
- Standard approach and requirements for designers and contractors

1 point — Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 15 or higher.

EQ C1.1.2 *Enhanced Ventilation Rate*

5 points — The outdoor airflow shall be no less than 130% of the value determined in accordance with the ASHRAE 62.1 ventilation rates.

EQ C1.1.3 *Dedicated Outdoor Air System*

5 points — Provide a dedicated outdoor air ventilation system (DOAS) that serves classrooms with the ability to efficiently process and manage ventilation down to the individual room level.

EQ P1.0-C1.1 IMPLEMENTATION

EQ P1.0 *Ventilation & IAQ*

CDs shall include design details and control sequences presented in a manner allowing that compliance with the prerequisite may be verified. In addition to information on the contract documents, calculations used to determine the most stringent outdoor air ventilation rate shall be signed by the project engineer. ASHRAE 62.1-2019 Mechanical Ventilation Calculation Worksheet shall be completed by the project engineer documenting that each space meets the minimum outdoor air quantities according to ASHRAE 62.1-2019 calculations. The spreadsheet shall show that the outdoor air quantity in each room served by an HVAC system meets the minimum outdoor air quantity for the space. For multiple spaces the spreadsheet shall show that the minimum outdoor air quantities are met in each space including during times when all VAV boxes are turned down to their minimum flow positions. A completed table shall be compiled by the project engineer and included in the project drawings and design documentation.

The table shall list for each room:

- the HVAC system ID number,
- HVAC type,
- the minimum outdoor air flow rate,
- the room's air classification, and
- all exhaust fans.

Minimum outdoor air quantities for all spaces shall be verified during HVAC system Testing and Balancing and included in minimum Commissioning requirements when all VAV boxes are turned down to their minimum flow positions.

Throughout this criterion, ventilation air means the designed outdoor air flow rate for maximum occupancy.

Controls shall be specified that operate the HVAC fans to provide outdoor air ventilation continuously during occupied hours, whether or not there is a need for heating or cooling. Thermostats with an "automatic" setting do not meet this requirement, since in this mode, the fans cycle on and off according to demands for heating or cooling.

The HVAC shall be operated continuously during working hours except during scheduled maintenance and emergency repairs, or during periods in which the district can demonstrate that the quantity of outdoor air supplied by non-mechanical means meets the outdoor air supply rate required by ASHRAE Standard 62.1-2019, §6.2 (i.e., climate is suitable and an acceptable means for natural ventilation is provided).

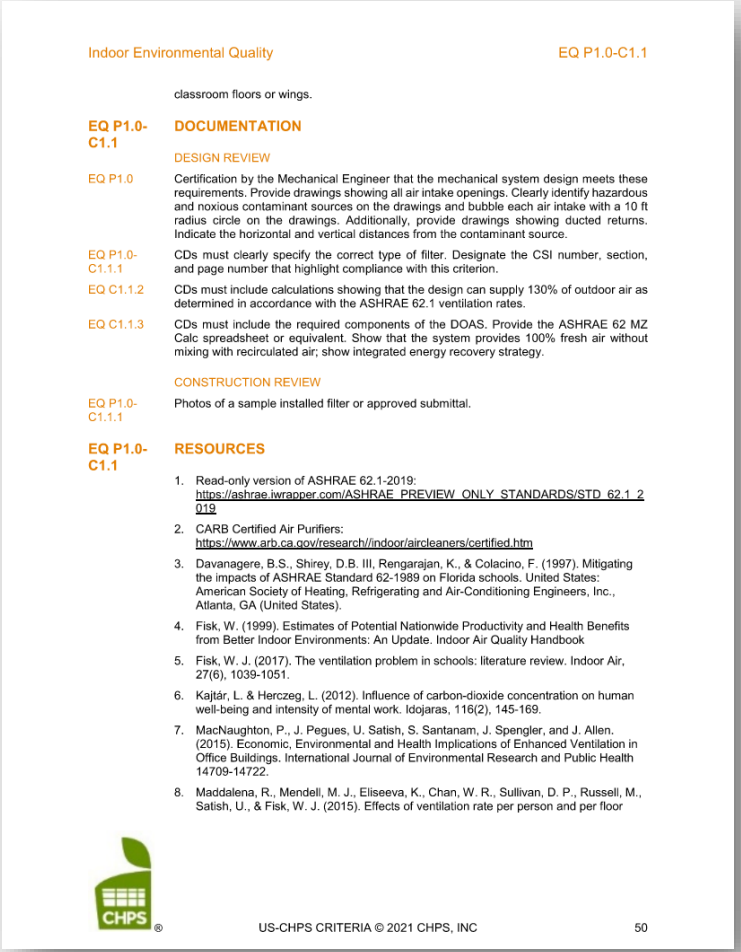
Natural ventilation systems must be engineered to demonstrate sufficient outdoor air ventilation and thermal comfort and shall adhere to natural ventilation guidelines, including:

Documentation:

- Requirements for designers and engineers for what should be included in documents
- Assists with accountability and review and certification of projects to ensure they meet requirements

Resources:

- Research and references that inform the criteria



classroom floors or wings.

EQ P1.0-C1.1 DOCUMENTATION

DESIGN REVIEW

EQ P1.0 Certification by the Mechanical Engineer that the mechanical system design meets these requirements. Provide drawings showing all air intake openings. Clearly identify hazardous and noxious contaminant sources on the drawings and bubble each air intake with a 10 ft radius circle on the drawings. Additionally, provide drawings showing ducted returns. Indicate the horizontal and vertical distances from the contaminant source.

EQ P1.0-C1.1.1 CDs must clearly specify the correct type of filter. Designate the CSI number, section, and page number that highlight compliance with this criterion.

EQ C1.1.2 CDs must include calculations showing that the design can supply 130% of outdoor air as determined in accordance with the ASHRAE 62.1 ventilation rates.

EQ C1.1.3 CDs must include the required components of the DOAS. Provide the ASHRAE 62 MZ Calc spreadsheet or equivalent. Show that the system provides 100% fresh air without mixing with recirculated air; show integrated energy recovery strategy.

CONSTRUCTION REVIEW

EQ P1.0-C1.1.1 Photos of a sample installed filter or approved submittal.

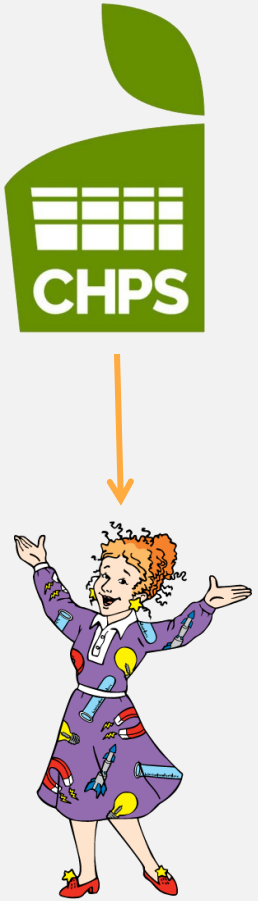
EQ P1.0-C1.1 RESOURCES

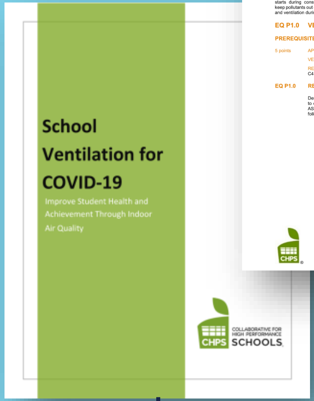
1. Read-only version of ASHRAE 62.1-2019: https://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_62.1_2019
2. CARB Certified Air Purifiers: https://www.arb.ca.gov/research//indoor/aircleaners/certified.htm
3. Davanagere, B.S., Shirey, D.B. III, Rengarajan, K., & Colacino, F. (1997). Mitigating the impacts of ASHRAE Standard 62-1989 on Florida schools. United States: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States).
4. Fisk, W. (1999). Estimates of Potential Nationwide Productivity and Health Benefits from Better Indoor Environments: An Update. Indoor Air Quality Handbook
5. Fisk, W. J. (2017). The ventilation problem in schools: literature review. Indoor Air, 27(6), 1039-1051.
6. Kajtár, L. & Herczeg, L. (2012). Influence of carbon-dioxide concentration on human well-being and intensity of mental work. Idojaras, 116(2), 145-169.
7. MacNaughton, P., J. Pegues, U. Satish, S. Santanam, J. Spengler, and J. Allen. (2015). Economic, Environmental and Health Implications of Enhanced Ventilation in Office Buildings. International Journal of Environmental Research and Public Health 14709-14722.
8. Maddalena, R., Mendell, M. J., Eliseeva, K., Chan, W. R., Sullivan, D. P., Russell, M., Satish, U., & Fisk, W. J. (2015). Effects of ventilation rate per person and per floor

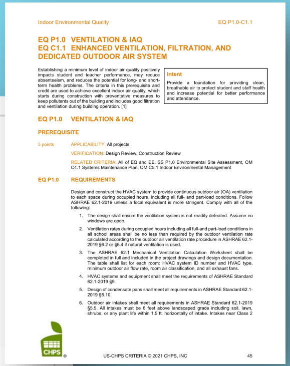
How can CHPS help?

Network of Districts, Professionals and Manufacturers dedicated to High Performance Schools

CHPS COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS MEMBER







Indoor Environmental Quality EQ P1.0-C1.1

EQ P1.0 VENTILATION & IAQ
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EQ P1.0 VENTILATION & IAQ

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VERIFICATION: Design Review, Construction Review

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CHPS

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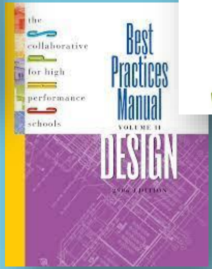

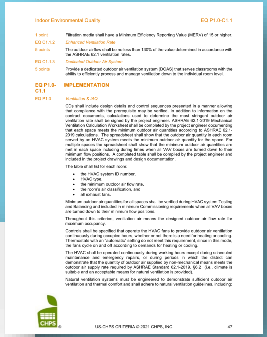

Indoor Environmental Quality EQ P1.0-C1.1

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EQ C1.1.2 *Enhanced Ventilation Rate*

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EQ C1.1.3 *Dedicated Outdoor Air System*

5 points Provide a dedicated outdoor air ventilation system (DOAS) that serves classrooms with the ability to efficiently process and manage ventilation down to the individual room level.

EQ P1.0-C1.1 IMPLEMENTATION

EQ P1.0 *Ventilation & IAQ*

CDs shall include design details and control sequences presented in a manner allowing that compliance with the prerequisite may be verified. In addition to information on the contract documents, calculations used to determine the most stringent outdoor air ventilation rate shall be signed by the project engineer. ASHRAE 62.1-2019 Mechanical Ventilation Calculation Worksheet shall be completed by the project engineer documenting that each space meets the minimum outdoor air quantities according to ASHRAE 62.1-2019 calculations. The spreadsheet shall show that the outdoor air quantity in each room served by an HVAC system meets the minimum outdoor air quantity for the space. For multiple spaces the spreadsheet shall show that the minimum outdoor air quantities are met in each space including during times when all VAV boxes are turned down to their minimum flow positions. A completed table shall be compiled by the project engineer and included in the project drawings and design documentation.

The table shall list for each room:

- the HVAC system ID number,
- HVAC type,
- the minimum outdoor air flow rate,
- the room's air classification, and
- all exhaust fans.

Minimum outdoor air quantities for all spaces shall be verified during HVAC system Testing and Balancing and included in minimum Commissioning requirements when all VAV boxes are turned down to their minimum flow positions.

Throughout this criterion, ventilation air means the designed outdoor air flow rate for maximum occupancy.

Controls shall be specified that operate the HVAC fans to provide outdoor air ventilation continuously during occupied hours, whether or not there is a need for heating or cooling. Thermostats with an "automatic" setting do not meet this requirement, since in this mode, the fans cycle on and off according to demands for heating or cooling.

The HVAC shall be operated continuously during working hours except during scheduled maintenance and emergency repairs, or during periods in which the district can demonstrate that the quantity of outdoor air supplied by non-mechanical means meets the outdoor air supply rate required by ASHRAE Standard 62.1-2019, §6.2 (i.e., climate is suitable and an acceptable means for natural ventilation is provided).

Natural ventilation systems must be engineered to demonstrate sufficient outdoor air ventilation and thermal comfort and shall adhere to natural ventilation guidelines, including:

CHPS

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COLLABORATIVE FOR HIGH PERFORMANCE
CHPS SCHOOLS
MEMBER

Existing Programs

Third-Party building standards only address new construction or major renovations.

LEED for Building Design and Construction (BD+C)
This rating system is for buildings that are new construction or major renovations.

LEED for Interior Design and Construction (ID+C)
This rating system is for interior spaces that are a complete interior fit-out

US CHPS Criteria 2.0
Criteria & Implementation Guide for New Construction & Major Renovation of School Buildings

- A major renovation is defined by a substantial improvement to a building of at least two of the following systems: lighting, HVAC, building envelope, interior surfaces, and/or site.

LEED

LIVING BUILDING CHALLENGE™

INTERNATIONAL WELL BUILDING INSTITUTE™

GREEN GLOBES

Expanded Focus

- Make CHPS criteria and resources applicable to all projects
- Help all schools improve the quality of their facilities
- Reduce barriers to entry for Districts, Design Teams and Communities
- Make CHPS an effective tool to improve every facilities decision
- Continue to implement new strategies to raise the ceiling

CHPS Minor Renovation Program

Need: Industry Standard for School Modernization Projects

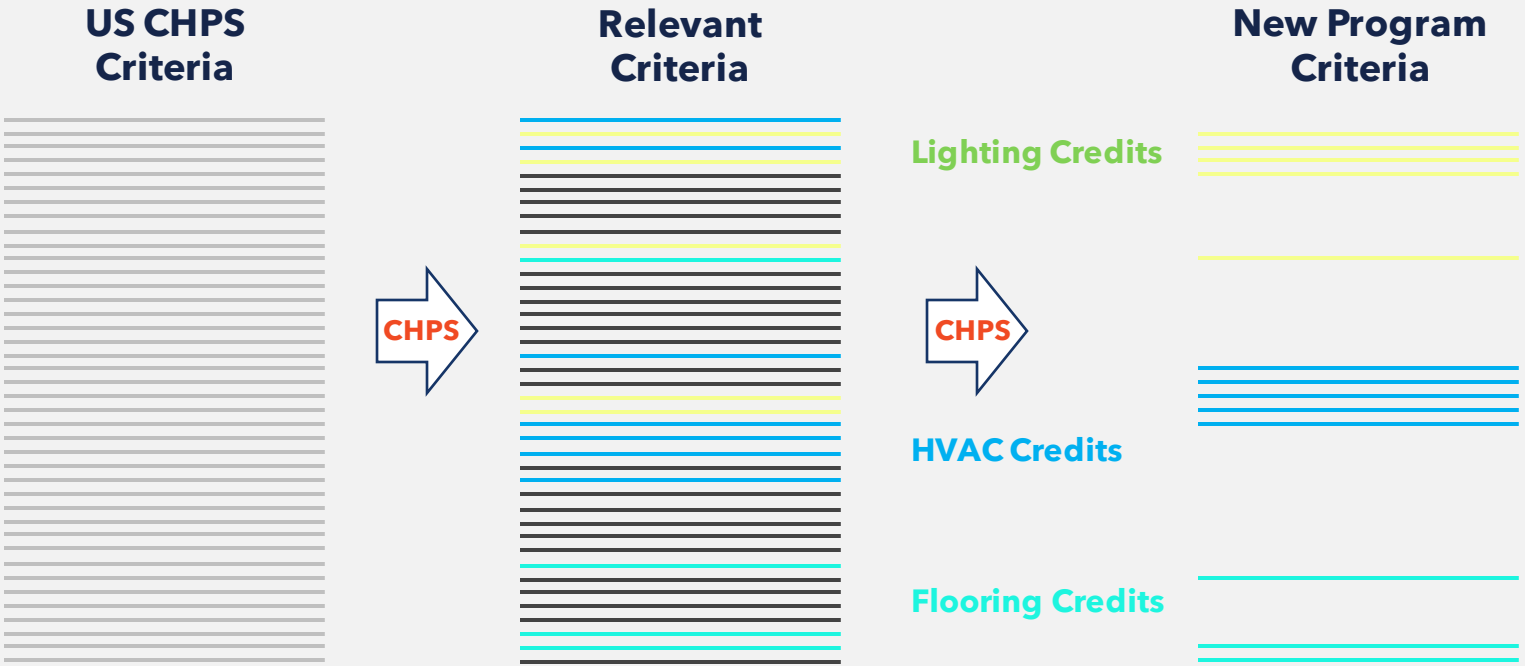
Districts need a school-specific third-party standard, adaptable to any school project, representing actionable best practices for the majority of their facility expenditures: individual school projects.

A standard that represents:

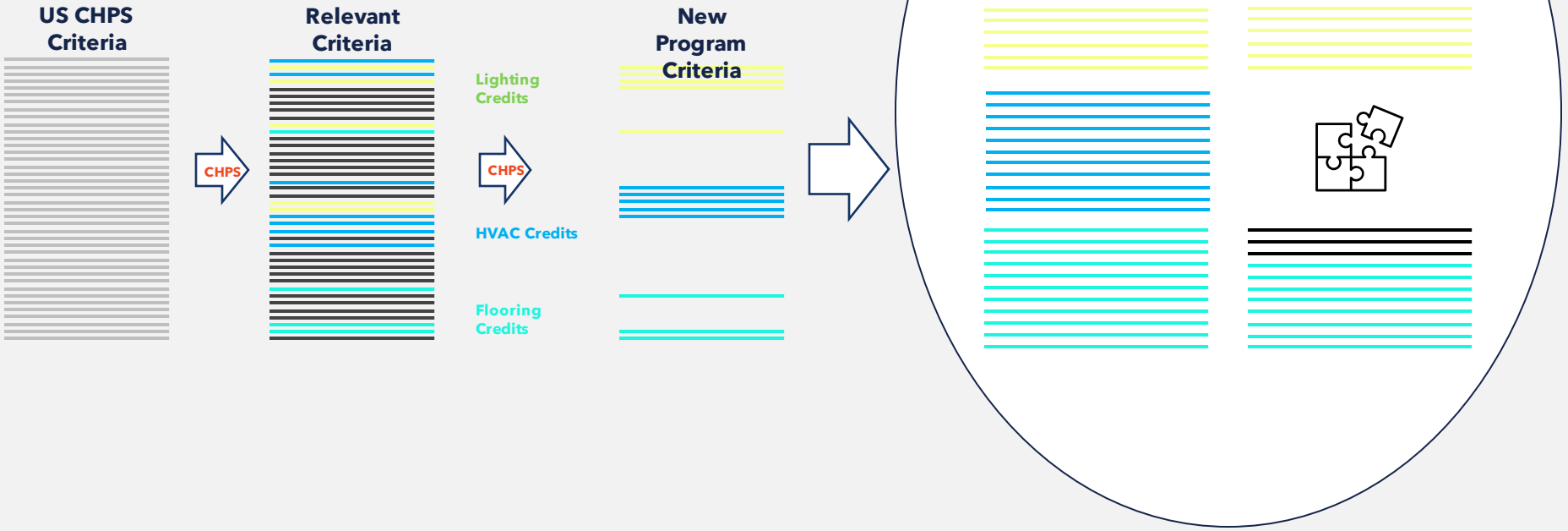
- Holistic and student-centric approach
- Actionable technical standards
- Industry collaboration & stakeholder alignment
- Stewardship of public funds

Third party verification?

New Program Creation Process



We need you here



VISIONARIES

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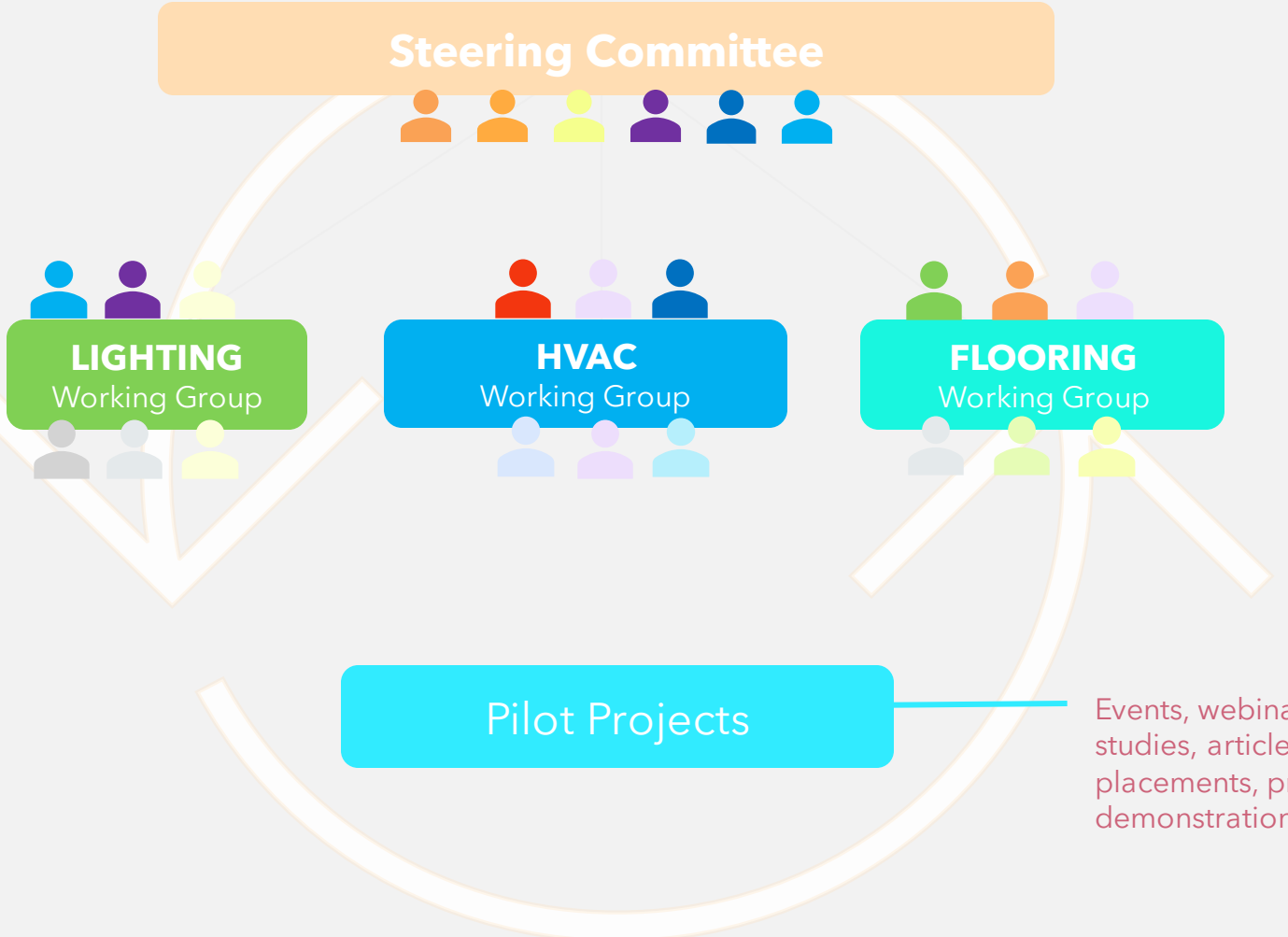
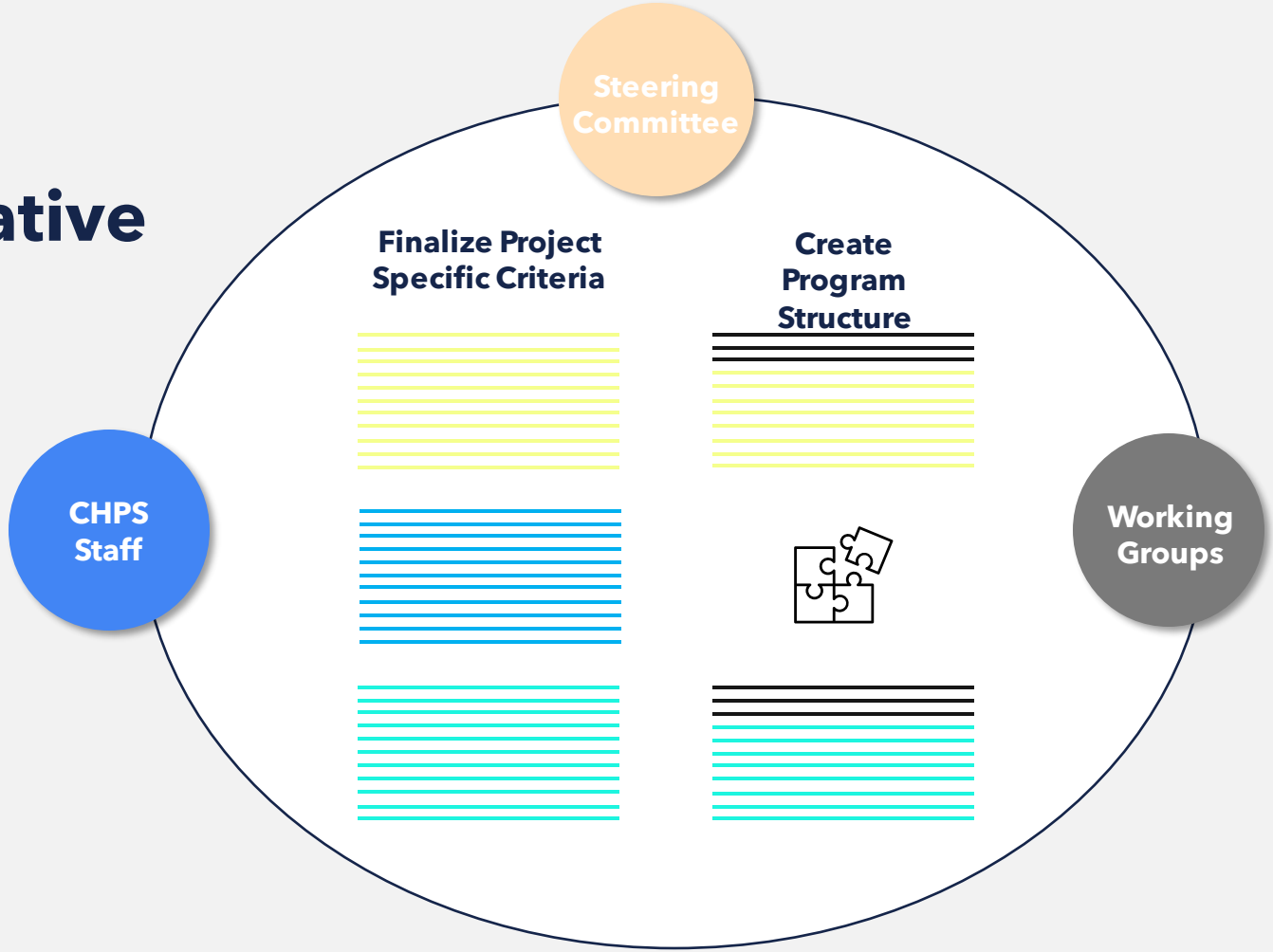


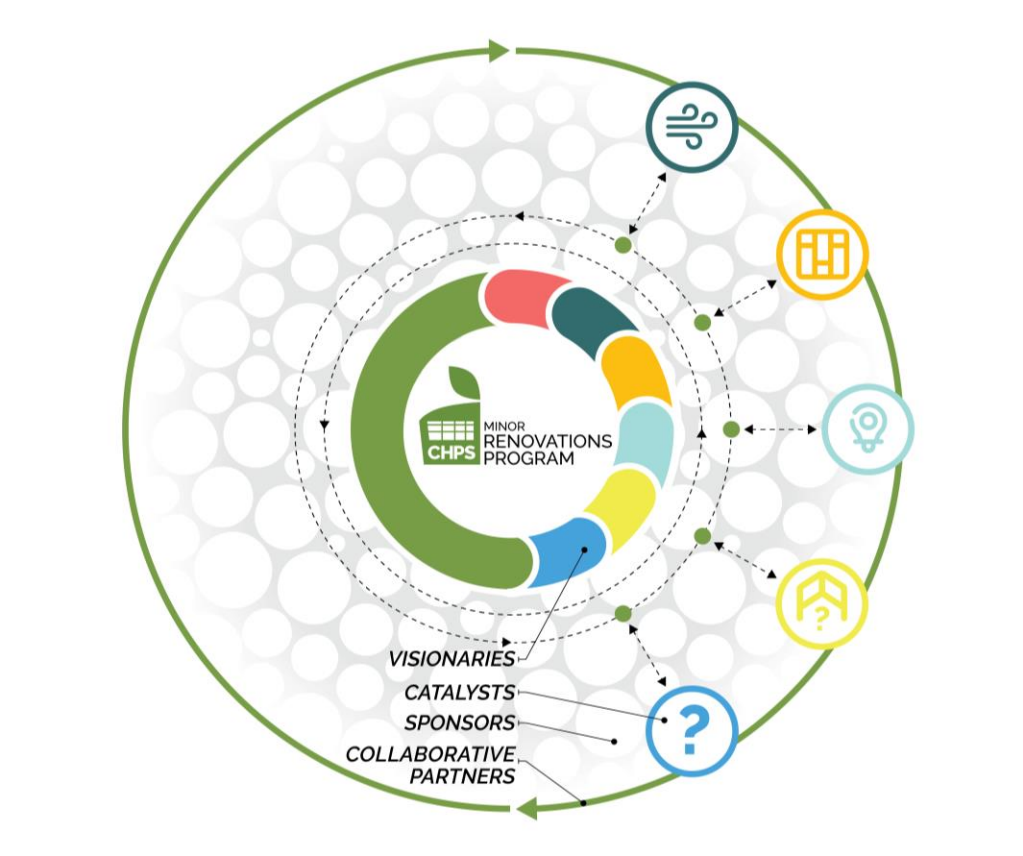
Collaborative Process



Do you think the CHPS Minor Renovation Program could be a helpful tool for your District, Clients, School and/or Community?

https://www.menti.com/al6mao2bhqex

Resources



Email
info@chps.net

Website
https://chps.net/minor-renovations-program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Thank you!