UCLA Luskin Center for Innovation

POLICY BRIEF | MAY 2023

Protecting Californians with Heat-Resilient Schools

GUIDANCE FOR AN EQUITABLE AND EFFECTIVE STATE STRATEGY

California's K-12 Education System is Under-Prepared for Rising Temperatures

California's K-12 public schools are vital institutions at every level: vital to the state's economic future, community wellbeing, as well as the lives of millions of children and hundreds of thousands of teachers and staff. Educators play an overwhelming number of roles for students and society at large. Given this, it is no surprise that funding to address extreme heat at schools has not been at the very top of the priority list. However, in recent years, temperatures have risen, leading to increasing concern about extreme heat and its insidious effects in schools.[1]

As the state develops and funds climate adaptation strategies, it is essential to address the effects of current and rising temperatures on students and staff while on school sites. California's 2022 **Extreme Heat Action Plan** begins to do so: it includes cooling schools in heat-vulnerable communities as a near-term focus.

This policy brief recommends specific research and policy actions to help advance the goals identified in the Extreme Heat Action Plan, as well as the equity goal set by the state's **Quality Schooling Framework** — that "*all* students are able to learn and thrive." Our five action areas and associated research recommendations build on existing findings, including in our 2021 report, ***Adapting to Extreme Heat in California: Assessing Gaps in State-level Policies & Funding Opportunities***.

Importance of Addressing Heat in Schools

Despite some progress, the nexus of schools and extreme heat is an understudied and underfunded area deserving of more targeted attention. This brief proposes an agenda for information, analysis, collaboration, and action to prevent children from experiencing excessive heat burden at schools. The following summarizes why such an agenda is important.

Summary of Policy Action Areas

We focus on five areas of action to advance heat resilience at schools and highlight where more research is needed.

- Track how schools experience extreme heat and the status of cooling interventions to understand needs
- Establish a statewide indoor temperature limit for schools based on children's risk and effects on learning
- Mitigate heat exposure in schoolyards through evidence-based engineered and nature-based solutions
- Manage heat exposure in schools through informed behavioral interventions
- Identify funding gaps and inconsistencies that should be addressed for effective, targeted heat mitigation

The Scope of this Policy Brief

This brief highlights some, but not all, of what may be needed to address heat in schools. It is not intended to be fully comprehensive. For example, it is outside the scope of this document to focus on labor-related actions. Additionally, we focus on actions that can be taken at the state level. Yet we recognize the critical role of school districts and schools to address heat. A focus on the local level, involving interviews with school employees, could be the subject of a separate paper on heat and schools.

Addressing extreme heat is only one piece of making schools more climate resilient. Our heat-specific action areas fit into a broader landscape of work for climate-resilient schools. To illustrate, the Climate Ready Schools Coalition calls for increased funding and a "Master Plan for Sustainable and Climate-Resilient Schools" to identify and guide a wider set of investments to promote equity, health and climate mitigation alike in schools.[2]

Learning losses: When schools cannot maintain comfortable indoor temperatures, students' ability to learn suffers. Without cooling equipment in classrooms, hotter temperatures lead to a marked decline in learning outcomes. For example, when it is very hot, students perform worse on exams, which can lead to lower graduation rates.[3] Yet not every California school has adequate access to indoor cooling, making it impossible to maintain temperatures ideal for teachers to educate and students to learn. And with limited statewide school facility data, it is difficult to know how widespread the problem is.[4]

Racial and regional inequities: Students of color and students in lower-income areas are the most affected by heat-driven learning losses, exacerbating racial and income-based achievement gaps. In fact, one study attributes five percent of the nationwide gap in academic achievement between white and Black students to heat and air conditioning disparities.[5] In California, heat inequities mean that students in inland communities (such as in the San Joaquin Valley) often face the hottest temperatures, which can reach life-threatening levels. Heat also interacts with other environmental injustices: for example, extreme heat compounds the harmful health effects of air pollution, which disproportionately harms communities of color and low-income communities.[6,7]

Safety risks: Parents have reported children getting headaches and experiencing excessive sweating from being exposed to high temperatures in classrooms without air conditioning.[8] And the problem of heat in schools extends beyond the classroom. In schoolyards, heat can cause unhealthy conditions for students playing sports or enjoying recess. Researchers have documented surface temperatures of 145 degrees Fahrenheit and above on school yards (see Figure 1, page 4).[9] Children prevented from playing outdoors due to extreme heat may miss out on the health and academic benefits of outdoor time and physical activity.[10,11]

Children's heightened vulnerability: Children are more vulnerable to the effects of heat than adults. Physiologically, their bodies may be less able to self-regulate in extreme temperatures due to lower sweat rates and high surface-to-body mass ratios.[12] Therefore, they can get dehydrated more quickly in extreme temperatures. Children also face a heightened risk of some health conditions, including asthma, when they experience extremely high temperatures.[13,14] Overheating at schools can lead to hospital emergency department room visits and missed school days.[15] Socially, children have less agency to take care of their needs by retreating to a cool area. And when considering the effects of hot protective sports equipment, heat-absorbing blacktops, and other intensifying factors, children often face particularly heightened heat exposures, and thus risk, at school.

ACTION AREA 1

Track how schools in California experience extreme heat and the status of cooling interventions to understand evolving needs for heat management

Status quo: There is currently no statewide database for tracking which schools do and do not have air conditioning, appropriately shaded schoolyards, and other heat interventions. There is no sufficient inventory of school maintenance and repair needs, including no standard system for tracking which schools have air conditioners that do and do not function properly.[16] While school districts do report data on their facilities to the California Department of Education, the data is difficult to access and not granular enough to assess cooling needs.[17]

As a result, it is impossible to get a complete picture of the need for interventions and how much those interventions will cost. This lack of data hampers the state's ability to take action and leaves districts to fend for themselves, which further deepens inequities due to different resource levels. Addressing data and information gaps at a state level is a critical first step to inform effective and equitable policy, investments and other action areas highlighted in this document.

Recommendations: We recommend that the state develop a method for tracking information related to heat management in schools. This method might include adding new elements to existing data collection systems, such as the School Accountability Report Card.[18] This reporting mechanism already includes questions about school facility conditions. Adding explicit questions about air conditioning and other heat management approaches would enable the state and other agencies and organizations to better understand the need for and progress toward heat resiliency in schools.

Example Interventions to Address Heat in Schools

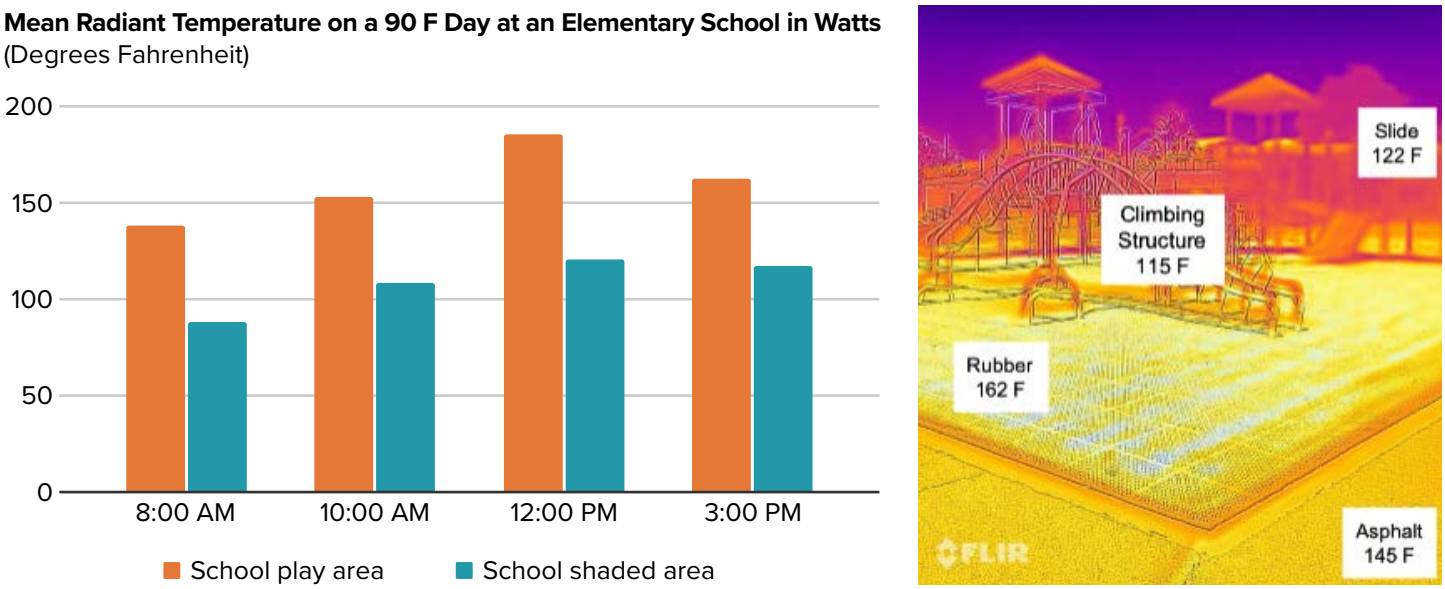
Built environment and nature-based interventions

- Improve school building envelopes (e.g., insulation, double-paned windows, window shading, and air sealing. From a broader resiliency perspective, ideally this would be done in combination with other health and safety upgrades to ensure good air quality (e.g., lead, mold, and asbestos remediation).
- Install cool roofs on schools.
- Plant trees to provide shade outdoors, both for the buildings and play areas.
- Install other outdoor shade structures, such as shade sails over playground equipment, outdoor dining, and other outdoor common areas.
- Decrease asphalt cover and increase permeable surfaces and natural ground cover, like gardens.
- Transition toward schoolyards with more trees and other greenery to reduce heat burden.[19,20]
- Install or improve cooling equipment (i.e., air conditioners or heat pumps), prioritizing energy-efficient equipment whenever possible.

Behavioral interventions

- During high-heat periods, modify activities, move inside to suitably cooled facilities, or reschedule outdoor activities (e.g., sports practices, games, outdoor play).
- Move children to air-conditioned rooms or cooler parts of buildings.
- Encourage children to take preventative behaviors, such as drinking water to stay hydrated.

Figure 1. Illustrating heat burden from high surface temperatures in schoolyards with and without shade



Playgrounds and play equipment can reach dangerously high temperatures on hot days, but shade can help to reduce temperatures and mitigate risk. Source: V. Kelly Turner and Morgan Rogers, UCLA.

In addition to the need for better quantitative data, it is important to have better qualitative data on the experiences and needs of school districts and school staff, especially those with first hand experience observing the impacts of extreme heat at their schools. Our research has identified temperatures at specific school playgrounds that could cause third degree burns (see Figure 1). In the classroom, media stories have highlighted that some California-based teachers feel they have no choice but to use noisy fans and distracting ice cubes to try to cool their students. The extent of the problem — let alone solutions — has not been fully assessed.

ACTION AREA 2

Establish statewide indoor temperature requirements for schools based on scientific assessment of children's risk and effects on learning

Status quo: Indoor temperatures in schools are not currently subject to any upper limits, and California K–12 schools are not required to have air conditioning or other cooling systems.[21] As a result, there are reports of some classrooms reaching high temperatures that affect student learning.[22] School design standards and building codes are determined by multiple sections of statutory law and regulatory code (see Figure 2). Specifically, California Education Code Section 17002(d) requires systems in public school facilities to "maintain interior temperatures within normally acceptable ranges."[23] A specific temperature range is not given.

California's **2022 Extreme Heat Action Plan** includes the recommendation to "explore implementation of indoor and outdoor heat exposure rules for schools." That point aligns with our following recommendation.

Recommendations: To maximize learning and health and reduce education inequality, students should be protected from extreme heat in the classroom. We recommend that the state collaborate with researchers and school employees to study — and then, as appropriate, develop — an evidence-based temperature limit for K–12 public school classrooms.

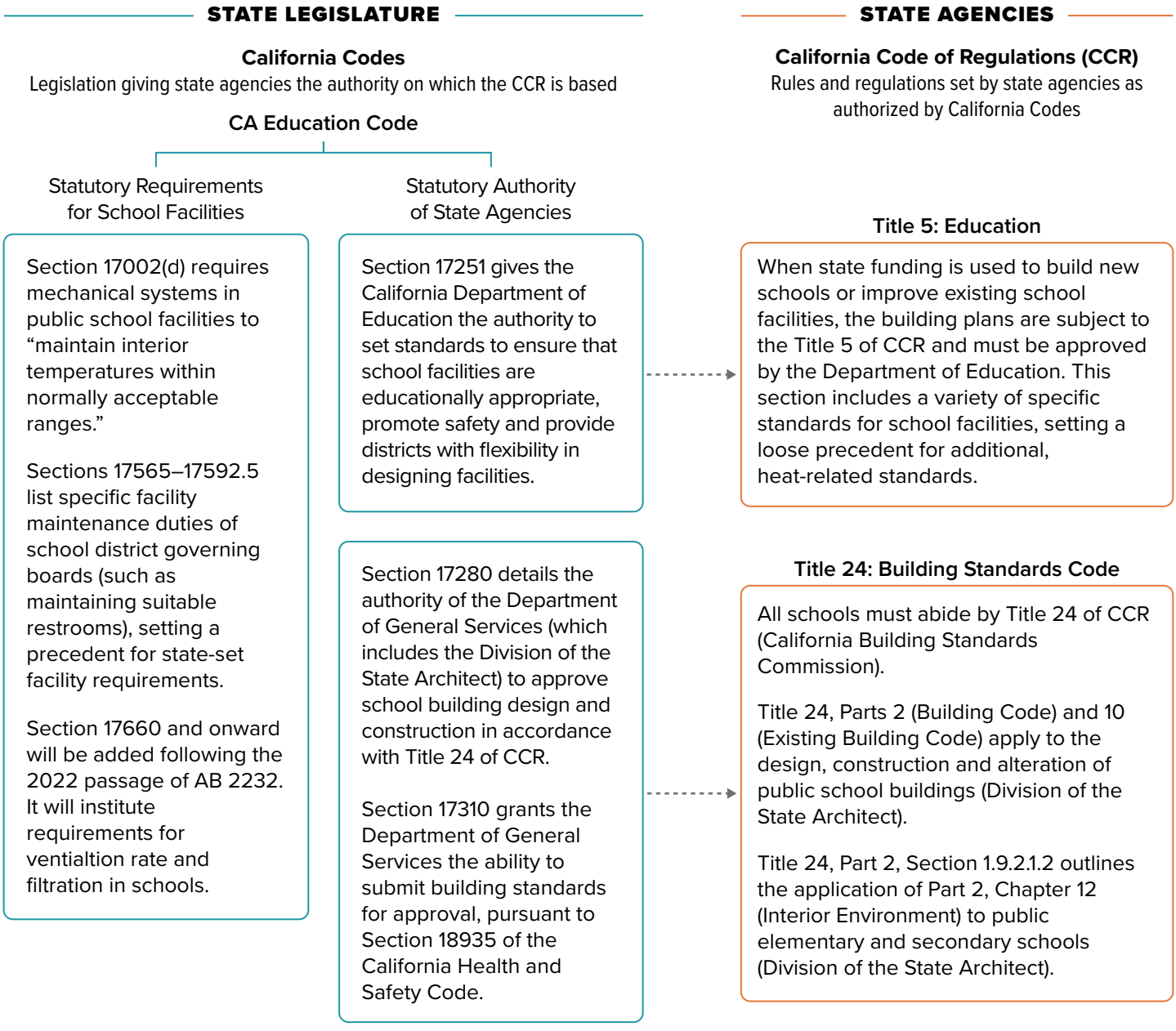
The process could be set in motion by state law (see call-out box on page 12 for mention of one such legislative proposal). The development and implementation of a

temperature standard could potentially be administered by the California Building Standards Commission and the Department of Education. The baseline standard could then be adopted by school districts, or districts could set a lower temperature limit if called for by local needs. Alternatively, the California Division of Occupational Safety and Health could establish a heat standard that would apply to school employees.

There is precedent and existing research to support establishing a healthy temperature range:

- Such standards are already in place for child care facilities: state license requirements mandate that these facilities maintain a temperature between 68 and 85 degrees Fahrenheit for rooms occupied by children.[24,25]
- Various experts have studied healthy temperature ranges, though there does not appear to be one cohesive temperature recommendation that has emerged. For example, the National Resource Center for Health and Safety in Child Care and Early Education recommends maintaining classroom

Figure 2. State Legislation and Regulations regarding School Facilities



temperatures below 82 degrees Fahrenheit and 50% relative humidity in the summer.[26]

- Other states and countries have established target temperature ranges, including New Zealand, which recommends maintaining a classroom temperature between approximately 64 and 77 degrees Fahrenheit when possible.[27]

Policymakers could collaborate with researchers (as well as teachers, students, and guardians) to expand existing research with further analysis to establish a healthy temperature limit for classrooms.

State enforcement of a temperature standard for schools would be complicated given the (limited) authority of state agencies and emphasis on local control. The state's primary enforcement mechanism for requirements set under Title 5 and Title 24 (see Figure 2) is funding eligibility around new school construction or modernization projects. School districts not seeking state funding for new construction or modernization projects will have little impetus to install cooling equipment to meet temperature requirements, unless enforcement authority changes or separate funding streams could instead be used. We advise that the state dedicate some of any future climate resilience funds toward cooling interventions at schools, in conjunction with funding for school building retrofits, energy efficiency, and other measures to keep schools cool with minimal use of air conditioning (see Action Area 5). With an upper temperature limit in place, many schools would need to upgrade their facilities or install new cooling equipment but would require financial incentives to do so.

There is precedent for requiring schools to provide facilities that support a healthy and safe learning environment:

- Public schools have been required to earthquake-retrofit their facilities to ensure the structural integrity and safety of buildings.[28] It is not a stretch to extrapolate such requirements to protect against other natural disasters, including heatwaves.
- The COVID-19 pandemic has prompted efforts for improved ventilation systems to address air quality in classrooms, leading to a new section being added to the Education Code in September 2022.[29] This parallel issue could be leveraged to require adequate cooling systems.
- There is precedent for air conditioning requirements for school accreditation at the state and local levels. For example, in Mississippi, school districts must provide air-conditioned classrooms to be accredited.[30]
- There is also precedent for cooling equipment requirements at the local level. For instance, Los Angeles Unified School District requires all classrooms to be equipped with working air conditioners.[31]

It is important to note that using traditional air conditioners is energy-intensive, which leads to tensions among three goals: cooling classrooms, reducing costs for schools, and reducing greenhouse gas emissions to mitigate climate change. While it is important to move away from energy-intensive air conditioners, it is just as critical to ensure that under-resourced schools have access to the same technologies and quality of learning environment as well-funded schools. The tensions among these three goals can be addressed by prioritizing the installation of efficient cooling technologies (primarily heat pumps) and helping schools, especially those located in heat-vulnerable communities, to afford the energy needed to run cooling equipment.

ACTION AREA 3

Support and facilitate nature-based and engineered features to reduce heat exposure in schoolyards

Status quo: Even if the state implements and enforces an indoor temperature threshold for California schools, the outdoor recreation areas on school campuses leave children exposed to heat. Kids spend time on playgrounds, sports fields, and courts during some of the hottest times of the day. In many cases, play areas with little or no shade are composed of dark asphalt "blacktops" that readily absorb heat and can reach extreme temperatures on hot days.[32] Similarly, sporting activities often take place on artificial turf, which gets hotter than real grass and can cause injuries.[33]

Trees share a courtyard at Herbert Ibarra Elementary School, San Diego Unified School District. Photo credit: Joe Wolf / Flickr

At Creekside Elementary in Tassajara, CA, the play structure is partially protected from the sun. Photo credit: Brian Shamblen / Flickr

California's building standards for school facilities do not currently require schools to mitigate heat exposure on school grounds.[34] In fact, there is limited state-level guidance on how to design school buildings that are climate-ready and heat-resilient. As a result of historical building guidelines and general trends, many schools have single-story, spread out campuses — a missed opportunity to produce shade for play areas and corridors through the built environment.[35,36] Yet creating school campuses with green space and heat protection can also benefit the wider community. For instance, schools could become Community Resilience Center sites due to their potential to provide broader services to mitigate community climate risk.[37]

The 2022 Extreme Heat Action Plan recommends that state agencies "partner with school districts, youth, and community-based organizations to accelerate school greening projects in tribal and climate vulnerable communities across the state." Additionally, the plan recommends "promot[ing] climate-appropriate shade tree cover at schools…" as part of a larger urban greening goal.[38] These points align with our recommendations below, which can provide additional direction and guidance for agencies.

The state has the authority to set standards that can protect students from heat in schoolyards:

- The Education Code gives the California Department of Education the authority to "establish standards for use by school districts to ensure that the design and construction of school facilities are educationally appropriate, promote school safety, and provide school districts with flexibility in designing instructional facilities."[39] Ensuring that schoolyards maintain safe temperatures for students and staff aligns with promoting school safety.
- Additionally, the Education Code lists several specific duties of school district governing boards with respect to maintaining school facilities (such as sterilizing football equipment or maintaining suitable restrooms), setting a precedent for specific standards set by the state.[40]
- The Building Code gives the Division of the State Architect, housed within the Department of General Services, authority to regulate the design, construction, and alteration of public school buildings. Therefore, this division has significant control over modifications to school grounds.[41]

Recommendations: Significant investment is needed to upgrade school facilities to ensure that outdoor common areas are shaded and otherwise minimize heat impacts for students and workers.[42] We recommend that the state consider how funding and policy levers could support the updating of schoolyards to meet the needs of a hotter climate. We also recommend that the state provide school districts with recommended best practices for heat mitigation strategies, for both new construction and modernization projects.

- **Shade:** We recommend that the state study the needs, legal and policy barriers, and opportunities related to increasing schoolyard shade coverage. Shade elements could include trees in and around play areas and shade sails over playground equipment and certain surfaces (e.g., rubber, artificial turf).[43,44,45] The amount of shade needed

to provide a safe environment is not established, but research is underway to develop guidance for playground design for thermal comfort.[46,47] In collaboration with researchers (as well as teachers, students, and guardians), the state can work to identify what amount of shade is sufficient, and then consider requiring and sufficiently funding districts to meet that minimal percentage of shade on schoolyards. Or the state could provide guidance for schools and districts to decide what constitutes enough shade on a case-by-case basis. In an era of limited resources, the state will also need to identify and prioritize which schools need shade most urgently, and how to pay for it.

- **Building design:** The state, in collaboration with researchers, could also examine how the construction of new school buildings can potentially contribute to passive cooling by providing more shade. This could mean recommending that new school buildings be taller or otherwise include more shade-casting features, as well as other possible design recommendations. Once the state has an understanding of how building design can mitigate heat exposure, it should provide a resource for schools to learn about these strategies.
- **Green space:** We also recommend that the state study barriers and opportunities associated with helping school districts transition from asphalt to cooler green space in schoolyards.[48] (See call out box "Barriers associated with interventions.") For example, liability issues are a barrier to planting trees in school grounds. Without clear guidance from the state, individual schools and districts classify and handle liabilities in very different ways. More consistent definitions may facilitate equitable greening investments across schools.

Barriers Associated with Interventions

In addition to the cost of installation, other barriers impede the implementation of several schoolyard heat interventions. Examples include:

- **Maintenance of and liability concerns regarding trees:** Planting trees in schoolyards can address heat by providing shade and bringing nature to students (and they can provide other benefits as well, such as food and educational opportunities). But they take years to mature enough to provide significant shade. They can also be costly to maintain. These difficulties make it challenging to argue for planting trees as a primary heat mitigation strategy, even though they bring multiple benefits.[78] In addition, there may be concern in some districts that trees in play areas can present liability issues (for instance, if children get injured climbing on them).
- **State requirements for installing shade structures:** State construction procedures and requirements may limit immediate actions and impede schools from taking low-cost emergency actions, such as putting up temporary shade structures, which may not meet safety requirements. For example, during a heat wave, a school might want to put up a pop-up tent to provide extra shade but not be able to due to state regulations.[79]
- **Exposing/remediating contaminated soil:** In some cases, asphalt and blacktops are installed partially in order to "cap" environmental hazards, such as contaminated soil. Removing these surfaces may result in the need for resource-intensive environmental remediation, which can be prohibitively expensive and time intensive.
- **Asphalt-oriented definition of play:** The Department of Education's Guide to School Site Analysis and Development sets requirements for how much hard-surfaced area must be available for different school sizes and grade levels.[80] Requirements are based in part on how the state defines "play" and how it determines what students need for different types of play. For schools with small outdoor areas, all or nearly all of the "play" surface may need to be hardcourt (e.g., for handball, basketball, and other activities).

An elementary school in Fort Bragg, CA, has windows shaded by solar panels. Photo credit: Missvain / Wikimedia Commons


An example of courtyard shade and a nature-based outdoor learning environment at Esperanza Elementary School, Los Angeles. Photo credit: V. Kelly Turner / Luskin Center for Innovation

- **Research:** Finally, we recommend that the state invest in additional studies to determine other effective, equitable, and cost-effective methods for reducing heat exposure in schoolyards. Before use, nascent technologies (such as cool pavements and play structure materials and paint) should be further explored for performance in a schoolyard context. This research should inform which new interventions California invests in alongside the more established interventions as part of a holistic approach to heat management.

ACTION AREA 4

Manage heat exposure in schools — indoors and outdoors — through behavioral interventions

Status quo: Establishing protocols or guidelines for how to handle extreme heat events is the responsibility of individual school districts and schools — there is no statewide standard.[49] Some California schools and districts (such as San Diego Unified[50]) have implemented heat response emergency planning and policies (for example, outlining whether to postpone sporting events or keep students indoors during heatwaves). However, in general, California schools are not required to adopt guidelines or policies that actively prevent heat-related illness or guide how schools respond to heat.[51]

Though multiple state agencies (such as the Department of Public Health[52]) provide guidance to help schools and districts respond to heat, a more unified set of guidelines or policies from the Department of Education could lead to more coherent heat responses. Currently, the Department of Education provides a limited set of guidelines on its webpage, referring schools to other agencies for more resources.[53] See page 12 for mention of an assembly bill that seeks to address this issue.

The 2022 Extreme Heat Action Plan recommends that state agencies "explore implementation of indoor and outdoor heat exposure rules for schools." That point aligns well with our following recommendation.[54]

Recommendations: We recommend that the state collaborate with researchers and school staff to study and consider establishing guidelines for heat-related illness prevention and response in schools. This could include the following measures and guidelines at the state level:

- A requirement for all schools or school districts to establish extreme heat emergency plans to protect students and workers. (Optionally, the state could create a baseline/template plan that school districts have the option to use and improve upon.)
- Guidance for creating these plans, including a recommended temperature or heat index[55] threshold at which outdoor play and athletic activities should be modified or canceled.[56]
- Educational packet on heat-related risks and preventative actions to be given to students and guardians each year.

ACTION AREA 5

Expand existing and establish new funding opportunities for heat mitigation strategies that target the most heat-vulnerable schools

Status quo: Funding for school facilities comes mostly from local sources and thus varies depending on local property wealth. The state also provides funding through the School Facility Program (see bullet below for more details). But concerns exist that the local matching-funds requirement and first-come, first-served approach privileges wealthier districts with greater administrative capacity.[57] (By contrast, most funding for school operations comes from a state funding formula that is keyed to the shares of low-income students, English Learners, and foster youth.)

Limited funding for general building maintenance and retrofits, especially for lower wealth areas, poses challenges for public schools as they seek to address extreme heat (as evidenced by a state auditor report in January 2022).[58] As a result, school districts sometimes push back necessary maintenance and improvements, which can increase costs in the long run.[59] These deficits disproportionately affect districts with relatively small budgets and limited staff resources to apply for and administer state funding programs. Some school districts that may be most in need of HVAC upgrades may also have the least capacity to apply for and administer the funding. More targeted technical assistance may be needed, at a minimum.

There are several ongoing state programs that can be used to fund heat management in schools — however, these programs are not specifically intended to address heat. Schools must balance state funds across many different needs, so funds not targeted at heat mitigation may be used for other needs. More detail can be found in our 2021 report.[60] Below is a sample of funding opportunities; we are not aware of a comprehensive list of all programs relevant to heat management in schools.

State Funding Program Examples:

- **California School Facilities Program (SFP):** The SFP provides grants for new construction (which can be used for schoolyard heat mitigation) and modernization of school facilities (which can be used for cooling equipment). While the aforementioned concerns about equity exist, the SFP may be one of the most promising avenues to heat management for schools.[61]
- **Green Schoolyards Grants:** These planning and implementation grants for schoolyard greening are administered by the California Department of Forestry and Fire Protection under the Urban and Community Forestry Program.[62]
- **Urban Greening (UG):** Provides funds to convert built environments into green space and "reduce GHG emissions, mitigate the effects of extreme heat, and provide multiple additional benefits."[63]
- **California Conservation Corps Energy Corps Program:** Provides retrofits that public schools can access, including air conditioning.[64,65]
- **The California Schools Healthy Air, Plumbing, and Energy Program (CalSHAPE):** Provides funds for "reasonable costs of HVAC assessment, general maintenance and adjustment … and other improvements to HVAC systems."[66]

In addition, federal funding may be available for heat mitigation. For example, a new grant program administered by the Department of Energy will provide funds for schools to upgrade facilities. The funds can be used for energy efficiency, which includes upgrading building envelopes and air conditioning.[67]

In addition to these existing programs, some 2023 legislative proposals would provide funding to address heat in schools. See page 12 for examples of legislative proposals.

Recommendations: We recommend that the state collaborate with researchers to analyze needs and opportunities to establish long-term funding opportunities dedicated to heat mitigation for schools. These opportunities could be designed to do the following:

- **Prioritize the most heat-vulnerable schools.** This benchmark may be defined based on some combination of local climate, lack of cooling equipment and shade, and socioeconomic disadvantages, such as lack of access to parks within a 10-minute walk. The Healthy Places Index: Heat Edition interactive tool provides a starting point to help identify heat-vulnerable schools.[68]
- **Make it easier for heat-vulnerable schools to access the funding.** At many school districts, staff do not have the capacity to apply for grant funding, which can lead to inequitable distribution of funds. Addressing this barrier may mean using and increasing formula funding, which avoids grant application processes that put low-resourced school districts at a disadvantage. At a minimum, it may require enhanced targeted technical support to ensure that heat-vulnerable school districts can benefit from grant funding.
- **Prioritize energy efficiency** by linking state funding for HVAC systems to building energy efficiency funding and requiring the installation of heat pumps whenever possible (along with providing sufficient upfront funds to purchase these more expensive pieces of cooling equipment, which can help school districts save money over time). To maximize energy efficiency, encourage schools to use other programs to holistically upgrade and weatherize buildings.
- **Remove barriers that prevent schools from maintaining and repairing installed equipment and infrastructure** (such as trees planted for shading buildings and schoolyards).[69] In collaboration with researchers, the state should more fully assess funding, policy, and other barriers and how these can be overcome. One strategy to address this need is for the state to invest in a workforce trained to maintain greener schoolyards.

Examples of funding barriers that warrant further exploration include the following:

- Some urban greening funding sources are limited to sites that are open to the general public a majority of the time. limits the number of eligible schools.
- School construction projects with budgets over a certain threshold must be accompanied with upgrades to meet Americans with Disabilities Act (ADA) standards. However, some funding cannot be used toward ADA upgrades. As a result, older schools that cannot afford ADA upgrades may avoid projects that put them over the budget threshold and are less likely to apply for some funds than newer, better-resourced schools that are already ADA-compliant.

While the need for investments in school infrastructure is broad, the urgent threat of extreme heat requires the state to prioritize heat-resilient building and landscape upgrades. This recommendation is consistent with the state's Infrastructure Report Card from the American Society of Civil Engineers (ASCE), which recommends that the state establish stable funding for school maintenance, noting that relying on local-level funding is insufficient and can be inequitable, due to spatial wealth and income inequality.[70]

In conclusion, to protect California's students and school employees — particularly those in under-resourced schools — a comprehensive suite of studies and informed interventions is necessary.

Examples of Other Legislative Proposals Seeking to Address California School Heat Management in the 2023–2024 Regular Session

- **AB 384 (Calderon):** Study recommended indoor air temperature ranges and temperature control standards for public schools and develop an inventory of heating and cooling systems for schools[71]
- **SB 499 (Menjivar):** Require school sites to develop and implement extreme heat action plans that include certain schoolyard greening actions, and require the state to provide guidance and a template for such a plan[72]
- **SB 515 (Stern):** Amend the CA Building code to allow exemptions to the disability upgrade standards to implement shade structures in K-12 schools, charter schools, and community colleges[73]
- **AB 527 (Calderon):** Require the Department of Forestry and Fire Protection to develop a competitive grant program for schoolyard greening and create a School Greening and Resiliency Fund to fund the program[74]
- **AB 927 (Muratsuchi):** Authorize school construction plans to include designs that promote an efficient response to extreme heat and climate change[75]
- **AB 1642 (Gipson):** Amend the Education Code to include temperature among the conditions that school construction plans must consider[76]
- **AB 1653 (Sanchez):** Integrate heat stroke into emergency action plans for school athletics[77]

Note: Inclusion on this list does not imply endorsement by the authors and is for educational purposes. These bills may evolve. The above summaries reflect initial language, accurate at the time this brief was written.

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Disclaimer

The views expressed herein are those of the authors and not necessarily those of the University of California, Los Angeles as a whole. The above listed names of advisors and reviewers does not imply endorsement of the content in this document, at an individual or organizational level.

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Notes

1 For example: CBS Los Angeles. (2022). Parents concerned LAUSD classrooms are getting too hot during heat wave. https://www.cbsnews.com/losangeles/news/parents-concerned-that-lausd-classrooms-are-getting-too-hot-during-heat-wave/

2 Climate Ready Schools Coalition. (2023, April 11). California master plan bill is a breakthrough for climate-resilient schools. Climate Ready Schools Coalition. https://www.climatereadyschoolscoalition.org/ourwork/california-master-plan-bill-is-a-breakthrough-for-climate-resilient-schoolsnbsp

3 Park, R. J. (2020). Hot temperature and high stakes performance. Journal of Human Resources.

4 Gao, N. and Lafortune, J. (2020). Improving K-12 School Facilities in California. Public Policy Institute of California. https://www.ppic.org/publication/improving-k-12-school-facilities-in-california/

5 Park, R. Jisung, Joshua Goodman, Michael Hurwitz, and Jonathan Smith. 2020. "Heat and Learning." American Economic Journal: Economic Policy, 12 (2): 306-39. https://www.aeaweb.org/articles?id=10.1257%2Fpol.20180612

6 Rahman, M. M., McConnell, R., Schlaerth, H., Ko, J., Silva, S., Lurmann, F. W., Palinkas, L., Johnston, J., Hurlburt, M., Yin, H., Ban-Weiss, G., & Garcia, E. (2022). The effects of coexposure to extremes of heat and particulate air pollution on mortality in California: Implications for climate change. American Journal of Respiratory and Critical Care Medicine, 206(9), 1117–1127. https://doi.org/10.1164/rccm.202204-0657oc

7 Pastor, M., Morello-Frosch, R., & Sadd, J. L. (2005). The air is always cleaner on the other side: Race, space, and Ambient Air Toxics Exposures in California. Journal of Urban Affairs, 27(2), 127–148. https://doi.org/10.1111/j.0735-2166.2005.00228.x

8 Aguilar, D. (2022). Parents raise concerns over hot classrooms in San Juan Bautista. https://www.ksbw.com/article/parents-raise-concerns-over-hot-classrooms-in-san-juan-bautista/41060182

9 Los Angeles Times. (2022). Playground asphalt sizzles to 145 degrees in extreme heat waves. Parents demand school shade. https://www.latimes.com/california/story/2022-09-01/school-playgrounds-sizzle-in-california-extreme-heatwaves

10 Coe, D. P., Peterson, T., Blair, C., Schutten, M. C., & Peddie, H. (2013). Physical Fitness, academic achievement, and socioeconomic status in school-aged youth. Journal of School Health, 83(7), 500–507. https://doi.org/10.1111/josh.12058

11 Bikomeye, J.C., Balza, J., and Beyer, K.M. (2021.) The Impact of Schoolyard Greening on Children's Physical Activity and Socioemotional Health: A Systematic Review of Experimental Studies. Int. J. Environ. Res. Public Health, 18(2), 535. https://doi.org/10.3390/ijerph18020535

12 Smith, C. J. (2019). Pediatric thermoregulation: Considerations in the face of global climate change. Nutrients, 11(9), 2010. https://doi.org/10.3390/nu11092010

13 Xu, Z., Sheffield, P. E., Su, H., Wang, X., Bi, Y., & Tong, S. (2013). The impact of heat waves on children's Health: A Systematic Review. International Journal of Biometeorology, 58(2), 239–247. https://doi.org/10.1007/s00484-013-0655-x

14 Uibel, D., Sharma, R., Piontkowski, D., Sheffield, P. E., & Clougherty, J. E. (2022). Association of Ambient Extreme Heat with pediatric morbidity: A scoping review. International Journal of Biometeorology, 66(8), 1683–1698. https://doi.org/10.1007/s00484-022-02310-5

15 Bernstein, A. S., Sun, S., Weinberger, K. R., Spangler, K. R., Sheffield, P. E., & Wellenius, G. A. (2022). Warm season and emergency department visits to U.S. children's hospitals. Environmental Health Perspectives, 130(1). https://doi.org/10.1289/ehp8083

16 American Society of Civil Engineers. (2019). Report Card for California's Infrastructure, p. 99. https://www.infrastructurereportcard.org/wp-content/uploads/2018/10/FullReport-CA_051019.pdf

17 Gao and Lafortune (2020) obtained much of the available facility data (which does not include an inventory of air conditioning) through a complex process of automated web scraping and natural language processing, demonstrating the level of time and expertise required to conduct a comprehensive review of school facilities even with the relatively limited data available. See the technical appendix of their report to learn more: https://www.ppic.org/publication/improving-k-12-school-facilities-in-california/

18 CA Dept of Education. (2023). School accountability report card (SARC). School Accountability Report Card (SARC) (CA Dept of Education). Retrieved April 26, 2023, from https://www.cde.ca.gov/ta/ac/sa/index.asp

19 There are multiple definitions of green schoolyards. One source that is useful for understanding the push for schoolyard greening is the following report: The Trust for Public Land. (2021). Green Schoolyards for Los Angeles: The Smart Policy Solution for Equity, Health, and Climate Resilience. https://www.tpl.org/wp-content/uploads/2022/09/Green-schoolyards-for-Los-Angeles-A-Trust-for-Public-Land-special-report.pdf

20 A study of schoolyard greening at a Los Angeles school suggests that schoolyard greening can increase students' physical activity levels, which is beneficial for their health. Raney, M. A., Hendry, C. F., and Yee, S. A. Physical Activity and Social Behaviors of Urban Children in Green Playgrounds. (2019.) American Journal of Preventive Medicine, 56(6). Published online: February 14, 2019.

21 California Code of Regulations, Title 5, Section 14030.

22 For example: CBS Los Angeles. (2022). Parents concerned LAUSD classrooms are getting too hot during heat wave. https://www.cbsnews.com/losangeles/news/parents-concerned-that-lausd-classrooms-are-getting-too-hot-during-heat-wave/ and Taketa, K. San Diego Union Tribune. (2022). Hot classrooms with no air conditioning make it hard to learn at San Diego High, families say. https://www.sandiegouniontribune.com/news/education/story/2022-09-01/air-conditioning-san-diego-high-school

23 California Education Code, Title 1, Section 17002 https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=EDC&sectionNum=17002.

24 Or 20 degrees cooler than outside temperatures in cases of extreme heat.

25 California Code of Regulations, Title 22, Section 101239.

26 National Resource Center for Health and Safety in Child Care and Early Education. (2019). Caring for Our Children: National Health and Safety Performance Standards Guidelines for Early Care and Education Programs. https://nrckids.org/CFOC/Database/5.2.1

27 New Zealand Ministry of Education. Managing thermal comfort in classrooms. https://www.education.govt.nz/school/property-and-transport/health-and-safety-management/managing-thermal-comfort-in-classrooms/

28 California Code of Regulations, Title 24, Part 10, Section 317.1.2 https://up.codes/viewer/california/ca-existing-building-code-2022/chapter/3/provisions-for-all-compliance-methods#317.1.2

29 California State Assembly. School facilities: heating, ventilation, and air conditioning systems, AB 2232, signed September 29, 2022. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB2232

30 Miss. Code Ann. § 37-17-6. https://advance.lexis.com/api/document/collection/statutes-legislation/id/652N-H053-CH1B-T3HM-00008-00?cite=Miss.%20Code%20Ann.%20%C2%A7%2037-17-6&context=1000516

31 Boessenkool, A. (2017). "Local LAUSD campuses set for $47 million in air conditioning upgrades." Daily Breeze. https://www.dailybreeze.com/2017/07/31/local-lausd-campuses-set-for-47-million-in-air-conditioning-upgrades/

32 Los Angeles Times. 2022. Playground asphalt sizzles to 145 degrees in extreme heat waves. Parents demand school shade.

33 Liu, Z., Jim, C.Y. 2021. Playing on natural or artificial turf sports field? Assessing heat stress of children, young athletes, and adults in Hong Kong. Sustainable Cities and Society, Volume 75. https://doi.org/10.1016/j.scs.2021.103271

34 California Code of Regulations, Title 5, Section 14030. https://www.cde.ca.gov/ls/fa/sf/title5regs.asp

35 California Department of Education. (2000). Guide to School Site Analysis and Development. https://www.cde.ca.gov/ls/fa/sf/guideschoolsite.asp

36 SWCA Environmental Consultants. (2015). Los Angeles Unified School District Design Guidelines and Treatment Approaches for Historic Schools. p. 18. https://achieve.lausd.net/cms/lib/CA01000043/Centricity/domain/135/pdf%20files/Final_Design_Guidelines.pdf

37 For example, see AB 1567: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240AB1567&search_keywords=heat

38 Track D, Goal 1, Recommended Actions 1 and 4. See California Natural Resources Agency. (2022). Protecting Californians From Extreme Heat: A State Action Plan to Build Community Resilience. Page 57. Retrieved April 9, 2023, from https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Climate-Resilience/2022-Final-Extreme-Heat-Action-Plan.pdf.

39 Education Code, Title 1, Section 17251. https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=EDC&sectionNum=17251.

40 Education Code, Title 1, Section 17565–17592.5.

41 California Administrative Code 2022, Chapter 4: Administrative Regulations for the Division of the State Architect—Structural Safety (DSA-SS), Article 1: Essential Services Buildings. https://up.codes/viewer/california/ca-administrative-code-2022/chapter/4/administrative-regulations-for-the-division-of-the-state-architect-structural-sa#4

42 Kennedy, E., Olsen, H., Vanos, J. et al. Reimagining spaces where children play: developing guidance for thermally comfortable playgrounds in Canada. Can J Public Health 112, 706–713 (2021). https://doi.org/10.17269/s41997-021-00522-7

43 Vanos, J. K., Herdt, A. J., & Lochbaum, M. R. (2017a). Effects of physical activity and shade on the heat balance and thermal perceptions of children in a playground microclimate. Building and Environment, 126. https://doi.org/10.1016/j.buildenv.2017.09.026.

44 Vanos, J. K., McKercher, G. R., Naughton, K., & Lochbaum, M. (2017b). Schoolyard shade and sun exposure: Assessment of personal monitoring during children's physical activity. Photochemistry and Photobiology.

45 There are also other types of shade, such as movable trellises and hedges, which can provide shade when the sun is lower in the sky.

46 Kennedy, E., Olsen, H., & Vanos, J. (2020). (rep.). Thermally Comfortable Playgrounds: A Review of Literature and Survey of Experts. National Program for Playground Safety. Retrieved from https://www.scc.ca/en/about-scc/publications/general/thermally-comfortable-playgrounds

47 Kennedy, E., Olsen, H., Vanos, J., Vecellio, D. J., Desat, M., Richters, K., Rutledge, A., & Richardson, G. R. (2021). Reimagining spaces where children play: Developing guidance for thermally comfortable playgrounds in Canada. Canadian Journal of Public Health, 112(4), 706–713. https://doi.org/10.17269/s41997-021-00522-7

48 Trust for Public Land. (2021). "Green Schoolyards for Los Angeles: The smart policy solution for equity, health, and climate resilience." https://www.tpl.org/wp-content/uploads/2022/09/Green-schoolyards-for-Los-Angeles-A-Trust-for-Public-Land-special-report.pdf

49 DeShazo, J. R., Lim, L., & Pierce, G. (2021). Adapting to Extreme Heat in California: Assessing Gaps in State-level Policies & Funding Opportunities. UCLA Luskin Center for Innovation.

50 San Diego Unified School District. (n.d.). Hot Weather Operations. Retrieved April 27, 2023, from https://www.sandiegounified.org/a-to-_z_index/hot_weather_operations

51 DeShazo, J. R., Lim, L., & Pierce, G. (2021). Adapting to Extreme Heat in California: Assessing Gaps in State-level Policies & Funding Opportunities. UCLA Luskin Center for Innovation.

52 California Department of Public Health. (2022, September 6). CDPH interim health guidance for schools on sports and strenuous outdoor activities during Extreme heat. CDPH Interim Health Guidance for Schools on Sports and Strenuous Outdoor Activities during Extreme Heat. https://www.cdph.ca.gov/Programs/EPO/Pages/Extreme%20Heat%20Pages/extreme-heat-guidance-for-schools.aspx

53 California Department of Education. (2022). Excessive heat. Excessive Heat - School Disaster and Emergency Management (CA Dept of Education). Retrieved April 27, 2023, from https://www.cde.ca.gov/ls/ep/extremeheat.asp

54 Track C, Goal 2, Recommended Action 9. See California Natural Resources Agency. (2022). Protecting Californians From Extreme Heat: A State Action Plan to Build Community Resilience. Page 44. Retrieved April 9, 2023, from https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Climate-Resilience/2022-Final-Extreme-Heat-Action-Plan.pdf.

55 National Weather Service. (2022). What is the heat index? National Oceanic and Atmospheric Administration. https://www.weather.gov/ama/heatindex

56 Healthy Children (from the American Academy of Pediatrics). (2022). Extreme Heat: Keeping Kids Safe When Temperatures Soar. https://www.healthychildren.org/English/safety-prevention/at-home/Pages/Protecting-Children-from-Extreme-Heat-Information-for-Parents.aspx

57 Lafortune, J. & Gao, N. (2022). Equitable State Funding for School Facilities: Assessing California's School Facility Program. Public Policy Institute of California. https://www.ppic.org/publication/equitable-state-funding-for-school-facilities/

58 California State Auditor. (2022). School Facilities Program. California Needs Additional Funding and a More Equitable Approach for Modernizing Its School Facilities. https://www.auditor.ca.gov/reports/2021-115/index.html

59 American Society of Civil Engineers. (2019). Report Card for California's Infrastructure, 99. https://www.infrastructurereportcard.org/wp-content/uploads/2018/10/FullReport-CA_051019.pdf

60 DeShazo, J. R., Lim, L., & Pierce, G. (2021). Adapting to Extreme Heat in California: Assessing Gaps in State-level Policies & Funding Opportunities. UCLA Luskin Center for Innovation.

61 Lafortune, J. & Gao, N. (2022). Equitable State Funding for School Facilities: Assessing California's School Facility Program. Public Policy Institute of California. https://www.ppic.org/publication/equitable-state-funding-for-school-facilities/

62 CAL FIRE. (2023). Urban and Community Forestry Grants. CAL FIRE. https://www.fire.ca.gov/what-we-do/grants/urban-and-community-forestry-grants

63 California Natural Resources Agency. (n.d.). Urban Greening Program. Retrieved March 1, 2023, from https://resources.ca.gov/grants/urban-greening/

64 California Natural Resources Agency. (2022). Protecting Californians from Extreme Heat: A State Action Plan to Build Community Resilience, 46. https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Climate-Resilience/2022-Final-Extreme-Heat-Action-Plan.pdf

65 California Conservation Corps. (2022). Energy Corps. https://ccc.ca.gov/what-we-do/conservation-programs/energy-corps-2/#:~:text=The%20California%20Conservation%20Corps%27%20Energy,surveys%2C%20and%20solar%20panel%20installations.

66 California Energy Commission. (n.d.). California schools healthy air, plumbing, and efficiency program - CalSHAPE. California Energy Commission. Retrieved February 7, 2023, from https://www.energy.ca.gov/programs-and-topics/programs/california-schools-healthy-air-plumbing-and-efficiency-program

67 US Department of Energy, Office of State and Community Energy Programs. (2022). Grants for Energy Improvements at Public School Facilities. https://www.energy.gov/scep/grants-energy-improvements-public-school-facilities

68 Public Health Alliance of Southern California in collaboration with the UCLA Luskin Center for Innovation. Healthy Places Index: Extreme Heat Edition. https://heat.healthyplacesindex.org/

69 Stokes, K. (2022). Some California Schools Skimped On Air Conditioning For Years. This Heat Wave Is Just The Beginning Of Their Problems. LAist. https://laist.com/news/education/los-angeles-unified-hvac-air-conditioning-heat-wave

70 American Society of Civil Engineers. (2019). Report Card for California's Infrastructure, p. 101. https://www.infrastructurereportcard.org/wp-content/uploads/2018/10/FullReport-CA_051019.pdf

71 California State Assembly. School facilities: recommended interior temperatures: inventory of heating and cooling systems, AB 384, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240AB384

72 California State Senate. Early childhood education facilities: school facilities: School Extreme Heat Action Plan Act of 2023, SB 499, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240SB499

73 California State Senate. School facilities: shade structures, SB 515, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240SB515

74 California State Assembly. Urban forestry: school greening projects: grants, AB 527, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240AB527

75 California State Assembly. School buildings: construction plans, AB 927, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240AB927

76 California State Assembly. School facilities: master plan for green schoolyards: recommendations, AB 1642, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240AB1642

77 California State Assembly. Interscholastic athletic programs: emergency action plans: heat illness: guidelines., AB 1653, 2023–2024 Regular Session. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240AB1653

78 Trust for Public Land. (2021). "Green Schoolyards for Los Angeles: The smart policy solution for equity, health, and climate resilience." https://www.tpl.org/wp-content/uploads/2022/09/Green-schoolyards-for-Los-Angeles-A-Trust-for-Public-Land-special-report.pdf

79 The procedures for school construction projects are set by the Division of the State Architect: https://www.dgs.ca.gov/DSA/Services/Page-Content/Division-of-the-State-Architect-Services-List/Certify-Construction-Projects-for-School-Essential-Services_Facilities. This issue is described in brief in an opinion article by LAUSD Board of Education Vice President Nick Melvoin. https://www.latimes.com/opinion/story/2022-09-16/schools-extreme-heat-california-lausd

80 California Department of Education. (n.d.). Guide to school site analysis and development. Guide to School Site Analysis and Development - School Facility Design. Retrieved April 27, 2023, from https://www.cde.ca.gov/ls/fa/sf/guideschoolsite.asp

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