SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
BOARD OF EDUCATION

Agenda Item# 11.4

Meeting Date: September 21, 2023

Subject: Carbon Neutral Goals and Guidelines for SCUSD Buildings

- ☒ Information Item Only
- ☐ Approval on Consent Agenda
- ☐ Conference (for discussion only)
- ☐ Conference/First Reading (Action Anticipated: _____)
- ☐ Conference/Action
- ☐ Action
- ☐ Public Hearing

Division: Facility Support Services

Recommendation: Receive information on proposed carbon neutral goals and guidelines for SCUSD buildings. A Board resolution will be forthcoming at a subsequent meeting to approve the proposed carbon neutral goals and guidelines.

Background/Rationale: Sacramento City Unified School District (SCUSD) is embarking on a process to design, construct, and modernize school buildings and facilities to achieve carbon neutrality by 2045, which is set by California Executive Order B-55-18, 2018. As part of the ongoing work outlined by the Facilities Master Plan that was Board approved in October 21, 2021, the District partnered with the New Buildings Institute (NBI) and the Sacramento Municipal Utilities District (SMUD) to develop District guidelines for prioritizing efforts to achieve building portfolio carbon neutrality by 2045, if not sooner. This includes portfolio and project level energy targets and timelines, as well as project requirements for new construction, major modernizations, and facility upgrades. This was a major component of the Facilities Master Plan.

Financial Considerations: These targets and guidelines will be incorporated in capital project design moving forward, which will positively impact the District's General Fund over time.

LCAP Goal(s): College, Career and Life Ready Graduates; Safe, Emotionally Healthy and Engaged Students; Family and Community Engagement; Operational Excellence

Documents Attached:

1. Executive Summary
2. Energy & Carbon Goals
3. Energy & Carbon Project Requirements

Estimated Time of Presentation: 10 minutes

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Approved by: Lisa Allen, Interim Superintendent

Board of Education Executive Summary

Facilities Support Services

Carbon Neutral Goals and Guidelines for SCUSD Buildings

September 21, 2023

I. Overview/History of Department or Program:

The SCUSD Facilities Master Plan (FMP) was approved by the Board in October 21, 2021 and included an American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Level II Energy Audit for each facility within the District's portfolio. With the help of a grant from the Sacramento Municipal Utilities District (SMUD), the District was able to work closely with New Buildings Institute to use the Audit data to determine the Energy Use Intensity (EUI) for each of the District's buildings. EUI is the amount of energy used per square foot annually, and is a strong indicator of a building's energy performance. That baseline was then used to develop EUI building level goals for all new construction, major modernizations, and retrofits of Sacramento City Unified School District's (SCUSD) building portfolio.

These goals are accompanied by a set of guiding standards to steer the construction process towards the EUI goals for each building and project type in the District. The District is working towards the California State goal of carbon neutrality by 2045. By utilizing a zero over time approach, SCUSD will achieve carbon neutral goals in a way that is cost effective, aligns with broader school District goals and plans, and accounts for other co-benefits such as occupant health, wellness, productivity, and reduced strain on environmental resources. Getting to zero carbon over time is a long-term, strategic effort to use policies and guidelines to achieve carbon neutral school buildings.

The California State goal of carbon neutrality by 2045 was outlined by Executive Order B-55-18 in 2018 which called for neutral carbon emissions by no later than 2045, and to achieve and maintain net negative emissions thereafter.

II. Driving Governance:

- California Executive Order B-55-18, 2018
- The District's Facilities Master Plan

III. Budget:

The Facilities Master Plan will help the District prioritize capital improvement projects focused on carbon neutrality and sustainability.

IV. Goals, Objectives and Measures:

To provide safe, environmentally adaptable, environmentally sustainable, modern schools and playfields.

V. Major Initiatives:

The energy and carbon goals and guiding standards will help lead District staff in the planning and design of capital projects and system retrofits in order to meet our EUI targets and achieve carbon neutrality by 2045. This process will center co-benefits such as the health and wellbeing of students and staff

VI. Results:

To develop Energy Use Intensity (EUI) targets and guidelines for District buildings to help guide the replacement, modernization, and/or new construction of District facilities.

VII. Lessons Learned/Next Steps:

Facilities staff will be bringing a Board Resolution to a subsequent meeting for the Board to approve the EUI targets and guidelines presented as part of this agenda item.

Energy and Carbon Goals for Sacramento City School District

April 2023

SUMMARY:

This document outlines the energy and carbon goals for Sacramento City Unified School District (SCUSD). Once adopted via a formal school resolution, these goals will be incorporated into a set of guiding standards to guide the construction process for each building and project type in the district. The district is working towards the California State goal of Carbon Neutrality by 2045. Utilizing a zero over time approach will help districts such as SCUSD achieve carbon neutral goals in a way that is cost effective and aligns with broader school district goals and plans. Getting to zero carbon over time is a long-term, strategic effort to achieve carbon neutral school buildings.

Achieving zero over time at the portfolio-level requires attention to individual buildings. Every opportunity in a building's lifecycle is seen as an opportunity for improvement in a zero over time approach. New construction, major modernizations, system retrofits and equipment replacement are all triggering events where energy efficiency and carbon neutral goals should be addressed.

In the process of adopting these goals – SCUSD will establish a baseline and set strategic, measurable, achievable, realistic, and time-bound goals regarding energy and carbon in buildings. Most projects in the existing pipeline can be leveraged to incorporate deep energy reductions and possibly renewable energy sources.

Achievable and quantifiable goals for districts on the path to carbon neutral school buildings vary depending on the lifecycle event. These are outlined for SCUSD within this document.

DEFINITIONS

ENERGY USE INTENSITY (EUI): EUI is an indicator of the energy efficiency of a building's design and/or operations. Expressed as energy use per square foot per year, EUI is calculated by dividing the total energy consumed by the building in one year by the total floor area of the building. EUI can be expressed as either "site" or "source" (defined further below).

GETTING TO ZERO OVER TIME: While getting to zero is a realistic goal, the path to healthy, efficient, zero carbon schools is a process that will take time to accomplish. Getting to zero over time takes a long-term, cost effective, and strategic approach to energy management. It leverages every opportunity for facility upgrades to continually improve energy performance. This process sets measurable goals for a portfolio and individual projects and uses policies and guidance documents to achieve these goals.

CARBON NEUTRAL: A carbon neutral school is a highly efficient building that has removed on-site fossil fuel combustion, most often used for space heating, hot water heating and in kitchens.

ZERO NET ENERGY (ZNE): A ZNE school is an energy-efficient building where on-site renewable energy production meets or exceeds energy used over the course of a year.

SITE ENERGY USE INTENSITY (Site EUI): Site EUI includes energy consumed (including heating, cooling, ventilation, domestic hot water, indoor and outdoor lighting, elevators, plug in equipment, etc.) on the building site as measured at the site boundary. Site EUI is calculated with the total energy use of the building at the meter, regardless of the source. Gas, electricity, and renewable energy are all converted to one unit (thousand British thermal units, or kBtu) and counted together.

SOURCE ENERGY USE INTENSITY (Source EUI): Source EUI includes site energy plus the energy consumed in the extraction, processing and transmission of primary fuels. Source EUI takes into account the total upstream energy that the building consumes, which means it is always larger or equal to the site EUI. The exact difference between the site and source EUI is a function of the fuel mix delivered to the building, as well as the building's location. Different regions of the country have varying energy sources and transmission infrastructure.

EXISTING DISTRICT ENERGY STATS FOR SCHOOL DISTRICT:

Average District Site EUI: 35.1 kBtu/sf/year

Number of Building Sites: 85 are included in this dataset. Two schools (Chavez and Kemble Elementaries are combined because they are on the same site and share a gas meter.)

School Name	Type	Site EUI *(kBtu/sf/year)*	Source EUI *(kBtu/sf/year)*
A. Warren McClacksey Adult Center	Adult Education	56	104
Abraham Lincoln	Primary (K-6)	38	91
A.M. Winn Public Waldorf	Primary (K-8)	37	82
Albert Einstein School	Primary (M)	N/A	N/A
Alice Birney	Primary (K-8)	33	80
American Legion High School	Secondary (H)	51	157
Arthur A. Benjamin Health Professions	Secondary (H)	42	109
Bowling Green Chacon Language and Science Academy	Primary (K-6)	20	58
Bowling Green McCoy Academy for Excellence	Primary (K-6)	34	82
Bret Harte Elementary	Primary (P-5)	31	83
Caleb Greenwood Elementary	Primary (K-6)	25	57
California Montessori Project - Capitol Campus	Primary (K-8)	25	54
California Middle School	Primary (M)	31	77
Camellia Basic Elementary School	Primary (K-6)	32	84
Capital City School (Independent Study)	K-12	19	52
Capitol Collegiate Academy	Primary (K-8)	40	90
Caroline Wenzel Elementary	Primary (K-6)	25	70
Cesar E. Chavez Elementary + Edward Kemble Elementary at Kemble Site	Primary (Kemble: K-3 and Chavez: 4-6)	COMBINED EUI: 35	COMBINED EUI: 73
Charles A. Jones Career & Education Center	Adult Education	53	129
C.K. McClatchy High School	Secondary (H)	42	95
Crocker Riverside Elementary	Primary (K-6)	22	62
David Lubin Elementary	Primary (K-6)	28	83
Earl Warren Elementary School	Primary (K-6)	53	131
Edward Kemble Elementary School	Primary (K-3)	38	82
Elder Creek Elementary School	Primary (K-6)	29	70
Ethel I. Baker Elementary School	Primary (K-6)	29	81
Ethel Phillips Elementary School	Primary (K-6)	31	80
Father Keith B. Kenny School	Primary (K-8)	46	115
Fern Bacon Middle	Primary (M)	38	73

G.W. Carver School of Arts and Science	Secondary (H)	29	72
Genevieve F. Didion Elementary	Primary (K-6)	33	91
Golden Empire Elementary School	Primary (K-6)	31	94
H.W. Harkness Elementary School	Primary (K-6)	32	77
Hiram Johnson High School	Secondary (H)	63	122
Hollywood Park Elementary School	Primary (K-6)	40	106
Hubert H. Bancroft Elementary School	Primary (K-6)	35	86
Isador Cohen Elementary School	Primary (K-6)	29	75
James W. Marshall Elementary School	Primary (K-6)	28	78
John Bidwell Elementary	Primary (K-6)	27	72
John Cabrillo Elementary School	Primary (K-6)	33	89
John D. Sloat Elementary	Primary (K-6)	40	95
John F. Kennedy High School	Secondary (H)	42	105
John Morse Therapeutic Center	Primary (K-8)	19	46
John Still Middle (East Campus)	Primary (M)	27	67
John Still Elementary (West Campus)	Primary (K-6)	28	85
Kit Carson International Academy	Secondary (7-12)	24	69
Language Academy of Sacramento	Primary (K-8)	42	133
Leataata Floyd Elementary	Primary (K-6)	23	56
Leonardo Da Vinci School	Primary (K-8)	32	71
Luther Burbank High School	Secondary (H)	33	81
Maintenance and Operations	District Building	57	111
Mark Twain Elementary School	Primary (K-6)	27	71
Martin Luther King Jr. School	Primary (K-8)	36	101
Matsuyama Elementary	Primary (K-6)	N/A	N/A
New Joseph Bonnheim Community Charter	Primary (K-6)	37	94
Nicholas Elementary School	Primary (K-6)	25	65
O.W. Erlewine Elementary	Primary (K-6)	37	86
Oak Ridge Elementary	Primary (K-6)	30	76
Pacific Elementary	Primary (K-6)	26	74
Parkway Elementary	Primary (K-6)	33	85
Phoebe A. Hearst Elementary	Primary (K-6)	37	88
Pony Express Elementary	Primary (K-6)	22	63
Print Shop/Nutrition Services	District Administrative Building	30	67
Rosa Parks School	Primary (K-8)	31	64
Rosemont High School	Secondary (H)	50	117
Sacramento Accelerated Academy	Secondary (H)	38	97
Sacramento Charter High School	Secondary (H)	44	96
Sacramento New Technology School	Secondary (H)	28	66
Sam Brannan Middle	Primary (M)	45	97

School of Engineering and Science	Secondary (7-12)	37	108
Sequoia Elementary	Primary (K-6)	26	65
Serna Center	District Administrative Building	45	126
Sol Aureus College Prep	Primary (K-8)	32	78
Success Academy	Primary (4-8)	21	47
Susan B Anthony Elementary	Primary (K-6)	29	77
Sutter Middle School	Primary (M)	26	68
Sutterville Elementary School	Primary (K-6)	35	84
Tahoe Elementary	Primary (K-6)	24	68
The Met High School	Secondary (H)	25	61
Theodore Judah Elementary School	Primary (K-6)	31	70
Washington Elementary School	Primary (K-6)	33	80
West Campus High School	Secondary (H)	50	116
Will C Wood Middle	Primary (M)	36	77
William Land Elementary School	Primary (K-6)	36	101
Woodbine Elementary	Primary (K-6)	27	75
Yav Pem Suab Academy	Primary (K-8)	25	71

PROPOSED BUILDING LEVEL GOALS:

Building Type	New Construction Site EUI[1]	Major Modernization Site EUI[2]	Retrofit EUI
Administrative	21-26 *kBtu/sf/yr*	25-33 *kBtu/sf/yr*	Retrofit projects will improve the site energy use intensity by 20-50% from a 2019 baseline weighted by the amount of work slated.
Primary School (K-5 and Middle)	19-24 *kBtu/sf/yr*	25-30 *kBtu/sf/yr*	
Secondary School (High School)	20-25 *kBtu/sf/yr*	25-35 *kBtu/sf/yr*	

Note: Sacramento is ASHRAE Climate Zone 3B[3].

For New Construction, ASHRAE dictates that an EUI of 21.1 for office, an EUI of 19 for primary and an EUI of 19.4 for secondary is feasible for new construction in Climate Zone 3B – but we have provided a range for design teams.

For Modernization, ASHRAE sets the standard that an EUI of 33 is achievable for office, an EUI of 30 for primary school, and an EUI of 33 for high school. Based on the NBI Getting to Zero database and past work in schools, we have amended the ranges above to be slightly more aggressive except for secondary schools which may have unique loads in some cases.

[1] New construction targets come from the ASHRAE Advanced Energy Design Guide for K-12 Zero Energy Schools and ASHRAE Advanced Energy Design Guide for Small to Medium Office for Administrative buildings: https://www.ashrae.org/technical-resources/aedgs/zero-energy-aedg-free-download

[2] Modernization targets come from ASHRAE Standard 100 targets for existing buildings which identifies that offices can achieve an EUI of 33, primary can achieve an EUI of 30, and secondary an EUI of 33.

[3] https://openei.org/wiki/Climate_Zone_3B

With the low average EUI across the district, the lower end of this scale should be achievable by these future projects.

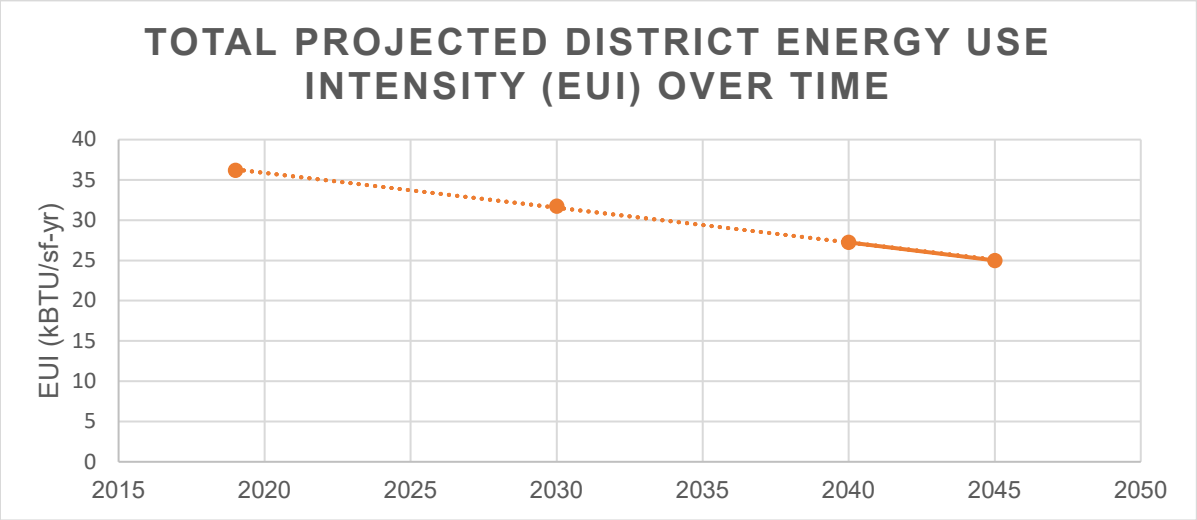
1. **All new construction/addition projects will:**
   - Achieve a site energy use intensity of **19-24 kBtu/square foot/year** before photovoltaic (PV), depending on building type,
   - Be all-electric and have no on-site gas combustion,
   - Be PV-ready for all projects (wherever on site appropriate),
   - Incorporate renewable energy sources to offset annual electricity use,
   - Reduce life cycle impacts associated with high embodied carbon materials,
   - Prioritize local products, manufacturers, and contractors to reduce carbon impacts in the supply chain,
   - Utilize low global warming refrigerants,
   - Consider the integration of electric vehicles and fleet infrastructure.
   - Consider battery storage (including parked school buses at the campus) and/or microgrid solutions supporting the PV system, for District and school resiliency, where practicable.

2. **All major modernization projects will:**
   - Achieve a site energy use intensity of **25-35 kBtu/square foot/year** before PV, depending on building type,
   - Either eliminate on-site gas combustion or have a plan to eliminate gas by 2045 (in a resolution or signed by the department director/superintendent)

3. **All school facility retrofits will improve the site energy use intensity by 20-50% from a 2018-2019 baseline weighted by the amount of work slated.**
   - Retrofitted systems should prioritize a shift to all-electric.
   - All retrofitted systems must be the most efficient equipment available whether gas or electric.

PROPOSED POLICY OR PORTFOLIO LEVEL GOALS

1. In line with California Executive Order B-55-18, SCUSD's building portfolio will achieve carbon neutrality by 2045[4].
2. This district will have an average portfolio site energy use intensity of **25 kBtu/square foot/year** (without PV).
3. Reduce energy consumption by 40% by 2030 and 80% by 2040.
    - **EUI in 2030: 31.10 kBtu/sf/yr**
    - **EUI in 2040: 27.10 kBtu/sf/yr**
4. Onsite gas combustion of zero by 2045.



[4] State of California Executive Order B-55-18 To Achieve Carbon Neutrality: https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf

Sacramento City Unified School District
Energy & Carbon Project Requirements

Developed in partnership with
New Buildings Institute

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INTRODUCTION

Guided by the FILL IN RESOLUTION WHEN ADOPTED the Sacramento City Unified School District (SCUSD) is embarking on a process to design, construct, and modernize school buildings and facilities to achieve carbon neutrality by 2045. Occupant health, student experiences, resource efficiency, and sustainability are important to our District and this Project Manual explains how the District aims to achieve the stated goals in all construction activities. Incorporating energy and carbon requirements into school design standards can make an immediate impact on health, attendance, academic performance, and teacher retention while decreasing operational costs.

The District has outlined the goals, processes, and guidelines found in this document to help protect students, staff, school visitors, and community members from the detrimental impacts brought on by climate change and to prepare our District for the transition away from on-site fossil gas use.

The District will strive to ensure all buildings are designed with occupant health, indoor environmental quality, and resource efficiency at the forefront. These buildings will prepare students for the future by providing a high-quality education that supports concepts and practices of sustainability. They will preserve current and future resources by adopting practices in design and operations that balance environmental, social, and fiscal responsibility to protect and enhance the quality of life.

This document dovetails with other District policies and documents, including the SCUSD Technical Specifications, Education Specifications, Board Policy 3511, and Administrative Regulation 3511. Together, they outline the guidelines and requirements for capital projects (new construction and modernizations) and facilities projects, which are defined below. This document will be revisited every 3 years to ensure goals and processes are still relevant and up to date.

Capital Projects: Capital projects include new construction, additions, rebuilds and major modernizations, often funded by voter-approved bonds and implemented by the Facilities Services Department.

Both new construction and modernization projects under the capital construction program will prioritize building envelope, HVAC, lighting, and removal of fossil fuel infrastructure to ensure all projects are designed to be as energy and carbon efficient as possible. Where opportunities arise modernizations will prioritize replacement of end-of-life roofs, windows, or heating systems, wherever possible.

Facilities Projects: Facilities projects are the building repairs and deferred maintenance projects managed by our Facilities Services Department. These projects are often funded by the school District maintenance and operations budgets. Examples of these types of projects include system and equipment replacement, lighting, lighting controls, and HVAC system improvements, end-of-life equipment replacement, and school program changes.

These projects generally have limited scope and will support energy and carbon goals by upgrading building elements as they reach their end of useful life. In each case, the District Energy and Carbon Guidelines below and Technical Specifications Document will inform the design and selection of materials and equipment.

DISTRICT ENERGY AND CARBON EMISSIONS GOALS

The District is committed to leveraging each opportunity to further progress toward achieving these goals. This includes bond-funded new construction and modernization projects, facilities retrofit projects funded with non-bond funds, as well as routine maintenance and operations practices. Energy and carbon emissions reduction opportunities should be considered any time the building envelope or energy using systems are addressed.

Portfolio Level Goals:

- Achieve building portfolio carbon neutrality by 2045, as required by California Executive Order B-55-18.
- Have an average portfolio site Energy Use Intensity (EUI) of **25 kBtu/sq ft/yr** (without PV). For comparison, the District's current average EUI is 35.1 kBtu/sq ft/yr without PV.
- Reduce energy consumption by 40% by 2030 and 80% by 2040. These goals are expressed as follows:
    - EUI in 2030: 31.10 kBtu/sf/yr
    - EUI in 2040: 27.10 kBtu/sf/yr
- Reduce onsite gas combustion to zero by 2045, as required by California Executive Order B-55-18.

Project Level Goals:

(1) All new construction projects will:

- Achieve a site energy use intensity of **19-24 kBtu/sqft/yr** without photovoltaic (PV), depending on building type,
- Have no on-site gas combustion (and will be all electric),
- Be PV-ready (where site appropriate),
- Incorporate renewable energy sources to offset annual electricity use, including, but not limited to, solar and geothermal,
- Reduce life cycle impacts associated with high embodied carbon materials wherever possible,
- Prioritize local products, manufacturers, and contractors to reduce carbon impacts in the supply chain,
- Utilize low Global Warming Potential (GWP) refrigerants that minimize (if not eliminate) global warming impacts that are non-toxic to the environment,
- Consider the addition of charging infrastructure for staff electric vehicles (including protected electric bicycle parking) and the District fleet (including buses and other heavy duty service vehicles),
- Consider battery storage (including parked school buses at the campus) and/or microgrid solutions supporting the PV system, for District and school resiliency, where practicable.

(2) All major modernization projects will:

- Achieve a site energy use intensity of 25-35 kBtu/square foot/year before PV, depending on the building type,
- Eliminate on-site gas combustion completely or include a designed plan to eliminate gas by 2045. The plan will come in the form of a board approved resolution and/or document signed by the Department Director, Project Sponsor, or Superintendent)

(3) All school facility retrofits will improve the site Energy Use Intensity (EUI) by 20-50% from a 2018-2019 baseline:

- Retrofitted systems should prioritize a shift to all-electric.
- All retrofitted systems must be the most efficient equipment available whether gas or electric.

CAPITAL PROJECTS - NEW CONSTRUCTION

The design team will incorporate the following elements into the construction process.

Processes

ENGAGE THE LOCAL COMMUNITY: The design team must seek authentic input and feedback from the local school community during the design phase.

DESIGNATE AN ENERGY CHAMPION: All projects must nominate an "energy champion" (EC) who will ensure that energy and carbon reduction are considered during the design process. The EC will sponsor an "eco-charrette," participate in stakeholder meetings, and will review the drawing set at the end of each design phase, and twice during the construction documentation phase (conceptual design, schematic design, design development and construction documentation). The EC shall participate in the Value Engineering (VE) process so that the long-term cost of ownership is considered in the VE process. The EC will engage SMUD pre-conceptual design for program offerings and technical support for the upcoming projects.

EMPLOY INTEGRATED DESIGN: Carbon neutral schools require highly structured collaboration among those who plan, design, construct, use, operate and maintain them. Integrated Design requires that team members from a variety of disciplines work together to consider the intersection of local climate conditions, building use patterns, building design and layout, building systems, and cost. Integrated design starts early. Engage the local electric utility (SMUD) early (ideally pre-conceptual design) for potential incentives and technical support through their SMUD Integrated Design Solutions incentive program. In the large bond programs, energy efficiency and carbon emission reduction strategies begin when estimating the cost of new construction and major modernizations.

Major construction and modernization projects will include an "eco-charrette" early in the design process. The eco-charrette will specifically focus on identifying the strategies and systems necessary for meeting the EUI targets. In addition, design teams will be expected to optimize

the interrelationships between the building orientation and building systems, surroundings, and occupants. The District's goal is to include as many passive energy design strategies as possible, such as natural daylighting and beneficial electrification that includes heat recovery.

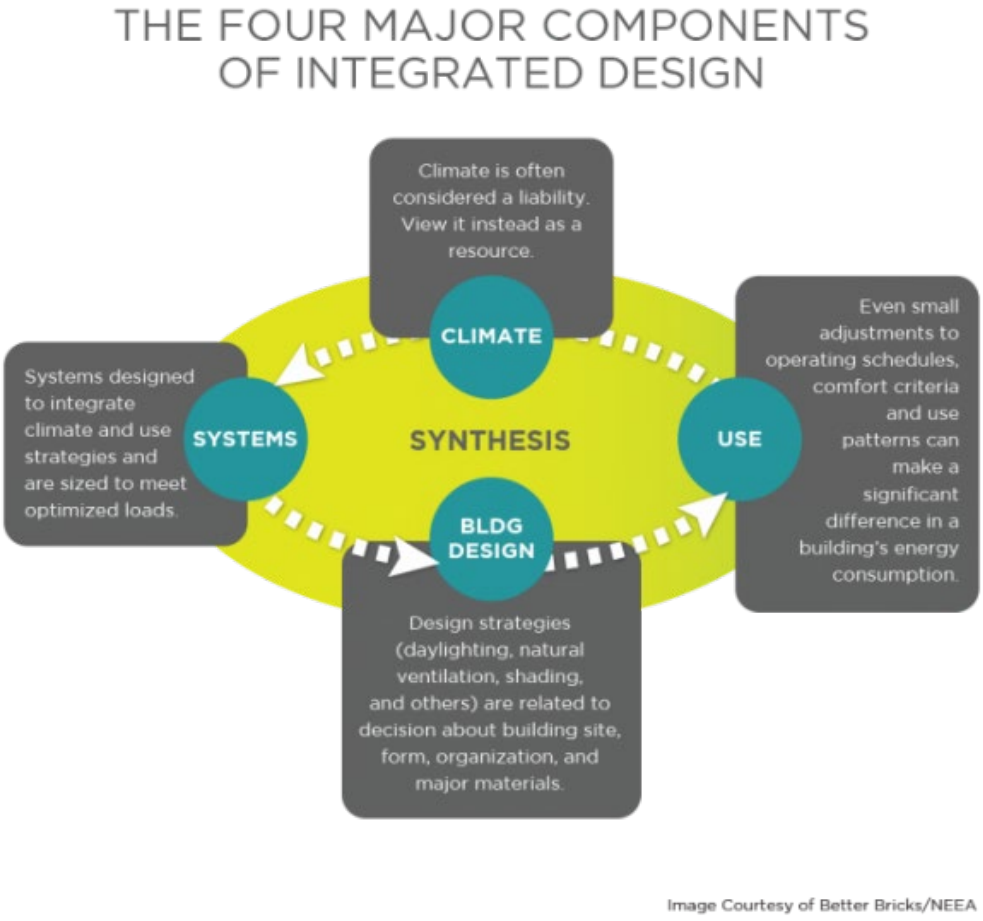

Image Courtesy of Better Bricks/NEEA

REDUCE ENERGY LOAD FIRST: A key strategy in integrated design is a "strategic implementation hierarchy" to optimize energy and carbon emission reductions. This strategy is particularly applicable to modernization project. The goal is to reduce energy loads first. By doing so, HVAC systems may be sized to accommodate the new (lowered) load, rather than designed to the former (larger) load. This saves energy and long term costs for the District. Though efficiency in the building envelope is an important part of energy reduction, the hierarchy may be different for each project. Consider selecting equipment that will meet ASHRAE Extreme Weather for a determined number of years out. Data is reported on 5, 10, 20, and 50 year. Selecting equipment for these higher outside air temperatures will protect the District in meeting these design conditions. Additionally, the equipment selected can operate more efficiently at part load.

PARTICIPATE IN UTILITY AUTO DEMAND RESPONSE PROGRAMS: Continue participation in the local electric utility (SMUD) auto demand response program, PowerDirect®. The financial incentives offered further encourage the District to shed load during critical electrical strain on the grid. These funds can be used to further optimize equipment operation.

Technical Approaches

Design teams will refer to the technical guidance contained in the design guide of the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), *Advanced Energy Design Guide for K-12 School Buildings: Achieving Zero Energy* (AEDG) to ensure the most efficient building approaches are utilized. These technical approaches are generally described below.

ENERGY MODELING: The design team will conduct energy modeling for every project. This model will be refined as details of the design come into focus. Modeling inputs should be clearly documented so any variances from modeled numbers during occupancy can be identified quickly. All plug loads (including security cameras, emergency lighting, IT equipment, fire alarms, and kitchen equipment) should be captured. For measures that are difficult to model in a given software, design teams shall be allowed to use external calculation methodologies to estimate the usages and savings. Methodologies utilized should receive approval by the District.

- An early energy model should be developed no later than the schematic design phase. Modeling will investigate building massing, orientation, and system type selection. This early model will analyze the relative energy impacts of various design decisions and will inform the system type selection. For example, a better insulated building envelope can reduce the size of the HVAC system, thus saving first costs.
- Later in the design process, energy models will investigate and estimate EUI to allow for comparison to goals and cost savings potential of energy conservation measures. These same energy model's estimates can also be used to size on-site renewables needed to achieve zero net carbon.
- Finally, an as-built model will be created to reflect the actual conditions in the new or modernized building. This model should be available to calibrate post-occupancy to verify assumptions and provide feedback to the District.

LIFECYCLE COSTING: To limit the adverse long-term impacts, the District requires that all value engineering decisions include consideration of life cycle costs. Interactive impacts of decisions will be considered before making first cost reduction decisions. Indirect, ancillary costs and benefits should also be accounted for, such as improved air quality and carbon reduction.

PROJECT CHECK POINTS: During the design and construction process, each project team will revisit and report progress on project EUI goals at these key checkpoints:

- At the end of each phase of the process (conceptual design, schematic design, design development, construction documents, and an as-built model).
- During construction mockups in the field when different disciplines must work together to ensure that the building envelope is airtight and energy using systems are integrated.
- During value engineering when the life cycle costs must be weighed against the first cost savings.

COMMISSIONING: Commissioning shall begin in design and follow through to post occupancy. Commissioning agents hired by the District will be brought into the design following each project through design, construction, and post-occupancy to ensure that the energy goals and design intent are achieved as outlined in this document and reflected in the Basis of Design (BOD) developed by the project team for each project. Each commissioning plan will include design reviews, construction inspections, functional testing, development of a maintenance manual, and systems training. Fundamental commissioning services (as defined by the US Green

Building Council LEED process) may be provided by the same organization whose representatives include design team members.

ENVELOPE COMMISSIONING: Envelope commissioning will be prioritized in all capital projects, this process begins with a blower door assessment and thermal imaging of the current building shell, where it will be retained, to identify leakage areas of concern. Existing envelope improvements should be prioritized based on the building testing results to ensure updates are maximizing performance improvement. Design teams should refer to the technical specifications of the AEDG for further details on building and building envelope commissioning.

TRAINING & STEWARDSHIP:

- All Facilities Service staff shall be trained by vendors and contractors, per written agreement, for any given construction project. Local utility service companies should be looped in to provide additional trainings in their area of expertise.
- It is critical that building occupants such as staff and students are properly engaged to operate a building efficiently, maximize savings, and obtain feedback about building operation. Occupants must feel ownership over their buildings carbon neutral performance and understand their individual and collective roles in sustaining carbon neutral performance for the long term. Example training materials include videos, manuals, and captivating signage. Examples of feedback include working with the Commissioning Agent to undergo post-occupancy commissioning.

FINANCIAL INCENTIVES: All projects will seek out local incentives and grants from utilities, Community Choice Aggregators (CCAs), Regional Energy Networks (RENs), and other local entities to help support District energy, carbon, and financial goals. It is important for the projects to seek these incentives as early as possible. This is due to utility incentives often have cut off times for participation. Additionally, SMUD offers third party, limited, technical support, also adding value to a project.

VERIFICATION: The measurement and verification (M&V) period typically spans 12 to 24 months after substantial completion of the building. During this time, the commissioning agent, design team, contractor, and energy modeler will work together with the District to review the energy performance of the project. This should be an ongoing and proactive process throughout the entire period so if anomalies are found between the expected site Energy Use Intensity and performance, and the actual site EUI performance, they can be identified and addressed quickly.

MAINTENANCE & OPERATIONS: Maintenance and operations is a key piece in ensuring that resource conservation and efficiency continue through the life of buildings and systems. This includes preventative maintenance, energy & water use monitoring, building automation system (BAS) monitoring, and continuous commissioning of HVAC and controls. Sustaining carbon neutral performance and reducing energy consumption in the long term should be more important than saving money in the short term by reducing expenditures on maintenance.

The M&O team will be a key participant in the retro-commissioning of the completed projects. Additionally, the team will undergo the following practices to ensure buildings are maintained appropriately.

- Defining and maintaining operational setpoints
- Equipment scheduling and periodic review to ensure match with occupancy schedules

- Checking sensor operation
- Filter changes, fan operation check, coil cleaning and other preventative maintenance tasks
- System flushing and checking steam traps
- Checking valves for leakage/failure
- Record keeping of systems and equipment to determine which systems either need maintenance or need replacement

EQUIPMENT SELECTION: Every effort shall be made to 1) Select maintenance-friendly, less complicated equipment, 2) Select equipment that is tested and proven (ideally in a K-12 setting); 3) Facilitate easy access to building systems (without ladders/lifts and without disturbing classes), and 4) Select materials that are easy to clean and inexpensive to maintain. Standardization of replacement materials, such as HVAC filter types and sizes, shall also be prioritized. The Maintenance and Operations team should be included in these discussions to provide team feedback on system selection.

CAPITAL PROJECTS - MAJOR MODERNIZATIONS

While new construction can be designed and built to meet the District's ambitious energy and carbon goals relatively straightforwardly and with minimal additional cost, retrofitting existing buildings to reach similar levels of efficiency may present a bigger hurdle. The District recognizes that parts of the building may be difficult to update to current standards, for example, meeting prescriptive envelope insulation levels within existing walls.

Despite these challenges, modernizations and retrofit projects are key opportunities to continually improve energy performance and reduce carbon emissions over time. As mentioned in the process section above, design teams will be guided by a strategic implementation hierarchy that calls for consideration of balancing energy load reduction, with attention to features such as the building envelope and lighting improvements, which should be balanced before HVAC upgrades. Minimizing heating load before replacing existing systems avoids oversizing of equipment and allows for replacement with equipment and/or systems that are more efficient and, where feasible, do not have on-site fossil fuel combustion.

Envelope commissioning will be prioritized in modernization projects, as with all capital projects, this process begins with a blower door assessment and thermal imaging of the current building shell, where it will be retained, to identify leakage areas of concern. Existing envelope improvements should be prioritized based on the building testing results to ensure updates are maximizing performance improvement. Design teams should refer to the technical specifications of the Advanced Energy Design Guide for K-12 School Buildings for further details on building and building envelope commissioning.

The chart below summarizes which elements will be incorporated into each modernization and retrofit project and which will only be included on a case-by-case basis. Design teams will consider the synergies with planned scope of work, available funding, and site-specific design parameters.

	MODERNIZATION	
SCOPE See further details below	Mandatory	Case-by-case
Envelope *air sealing and insulating walls and openings*	✓	
Roofs *insulation, rainwater collection*		✓
Glazing & Shading *heat minimization, high performance windows*		✓
Lighting *LED lighting & controls*	✓	
Electrical *energy monitoring*	✓	
Metering *submetering*		✓
Kitchen *electrification & Energy Star energy-efficient equipment*	✓	
Heating *electrification & maintainability*		✓
Ventilation *heat recovery & filtration*		✓
Controls *set points & operating hours*	✓	
Domestic Hot Water *recirculation pumps & pipe insulation*	✓	
Plug Loads *are measured & controlled*	✓	
Water *backflow device & high-efficiency fixtures*	✓	
Schoolyard *green schoolyards, stormwater mgmt. & rainwater collection*		✓
Materials *CalGreen, CA Section 01350 & CA Buy Clean*	✓	
Renewables *Onsite solar PV, storage*		✓
Zero Energy Ready *roof solar readiness*	✓	

FACILITIES PROJECTS

The Facilities Department is an integral part of the District's efforts to care for and improve its building stock, tackle deferred maintenance, and achieve energy and carbon goals. Typical work includes lighting retrofits, control upgrades, window retrofits, roofing replacement, installation of information technology, security or fire alarm systems, and replacement of boilers or other aging equipment.

Facilities projects shall adhere to the following overarching decision-making processes in order for those projects to align with the District's goals and project processes:

- The energy champion shall be consulted and provide guidance on incorporating energy efficiency and carbon emission reduction into the design of retrofits and replacements.
- Specifications for new equipment will match those for new construction unless prohibited by Division of State Architect's Interpretation of Regulations (IR) A-22 or this change requires significant and costly expansion of electricity infrastructure. This will avoid like for like replacements and ensure that replacement equipment will be more energy efficient.
- New fossil fuel burning equipment will not be installed.

The District Technical Standards and Specifications are to be consulted for all Facilities projects so architects working on these projects continue to work to achieve the District's energy and carbon goals.

DISTRICT ENERGY AND CARBON GUIDELINES

In order to adhere to the goals set forth by the District, design teams will consult the Advanced Energy Design Guide for K-12 School Buildings (AEDG): Achieving Zero Energy (ASHRAE) and follow the *Energy and Carbon Guidelines* below. While these guidelines are most easily implemented in new construction, they should also be utilized where applicable in other projects. For reference, Sacramento County is in ASHRAE Climate Zone 3B: Warm Dry. All requirements below reflect the modeled capabilities of this climate zone.

ENERGY

New buildings should be designed to achieve a modeled site energy use intensity (EUI) of **19 kBtu/sf/year** for primary schools and **19.4 kBtu/sf/year for secondary schools** including plug loads, security cameras, IT & fire alarm systems, and kitchen equipment. Building systems should be "designed for off", meaning that they will shut down without user intervention. Energy modeling during design should confirm that site EUI targets are achieved.
Reference: Table 3-1 of the Advanced Energy Design Guide for K-12 School Buildings

FORM & SITING

Buildings should be simple and compact, integrated into the landscape, oriented to allow for daylighting while managing solar gain, minimizing glare and maximizing renewable energy production. Building form should consider exterior circulation to minimize the need for conditioned common areas and stacking functions to promote energy efficiency.

ENVELOPE

Roof, wall, slab edge, and door insulation will be continuous and optimized via building modeling to comply with the EUI target above. In general, a roof U-factor of 0.039 and wall U-factor of 0.064 should be specified. Exterior insulation should be specified over cavity insulation and fiberglass batts should be limited in certain circumstances due to poor thermal performance in the field. Double swinging doors without a center post or rolling overhead doors without insulated panels are discouraged due to poor air sealing properties.
Reference: Table 5-3 of the Advanced Energy Design Guide for K-12 School Buildings

If PV panels are mounted to the roof, the roofing system must be able to handle uplift from the panels. Attachments for PV panels need to minimize thermal bridging (see section EN35 in the Advanced Energy Design Guide for K-12 School Buildings).

AIR & MOISTURE CONTROL

Moisture and air control layers will be continuous and reside on the warm side of exterior insulation, and architects will design and specify airtight construction practices (.25 CFM/SF @ 75 Pa).
Reference: As noted in section EN2 of the Advanced Energy Design Guide for K-12 School Buildings

INSULATION

Roof, wall, slab edge, and door insulation will be continuous and optimized via energy modeling to comply with the EUI target above and to minimize the cooling dominated climate zone. In general, R30 roof and R20 wall insulation should be specified.

WINDOWS

Windows and skylights will have U-values <.30 and thermally-broken frames. Windows size and Solar Heat Gain Coefficients (SHGC) will be tuned to building orientation, with north and

(shaded) south-facing glass being larger and having a higher SHGC than east or west-facing glass. Windows should additionally consider the access to views for building occupants.
Reference: Table 5-5 of the Advanced Energy Design Guide for K-12 School Buildings

SHADING

The need for glare and heat control (on E/S/W elevations) should be determined through daylight modeling and provided via exterior shading devices.

- **Interior shades** will be provided in all classrooms and offices.
- **Exterior building shades** will be provided, with consideration of solar angled or perforated sunshades.
- **Exterior ground shading**:
    - Shading must cover at least 50% of the parking area. All parking shade structures will have PV arrays.
    - Shade tree plantings will be required over at least 20% of the landscape area and 20% of the hardscape area within 15 years, with landscape irrigation necessary to establish and maintain tree health (per Title 24).

DAYLIGHTING

Whenever possible, buildings will utilize natural light to meet lighting needs. Acceptable strategies include sloped ceilings, light louvers, clerestories, reflective interior surfaces, sun tubes, and skylights along interior walls.

LIGHTING

In general, lights should run parallel to windows, with the closest bank controlled via daylight sensors. Lights in daylit stairs or hallways should be similarly controlled. Skylights, sun tubes, or light wells may be considered in permanently occupied spaces without access to natural light provided that rooftop solar requirements can be met.

- **Interior lighting** will be 100% LED, with manual on/auto off in classrooms/offices, occupancy sensors in common areas, and daylighting controls per Title 24. A Lighting Power Density (LPD) of 0.4 watts/sf or less shall be achieved. Architects should refer to the District's Technical Standards and Specifications for appropriate light levels, set points, and design guidance for each space type. Zoned lighting should be considered where appropriate to utilize lighting systems only when needed.
- **Exterior lighting** will also be LED, incorporate bi-level control, and astronomical time clocks.

ELECTRICAL

Size of new transformers and switchgear should be right-sized. They will be evaluated based on future electric heating and solar loads wherever possible. Often electrical equipment is already oversized and with energy efficiency measures in place, the increase in size may not be needed. This should be carefully evaluated for each project. Electrical rooms should provide a spare breaker for future PV panels and space for a solar inverter. Plug loads (controlled and uncontrolled), electrical systems (cameras, fire alarm, IT), lighting, heating/cooling, ventilation, kitchen equipment, and DHW should be monitored and may be separately sub-metered if cost effective and appropriate in new buildings and when subpanels are replaced in existing ones. Electric vehicle and bus infrastructure should be considered where appropriate.

An energy monitor and comprehensive energy dashboard are to be installed in all new and modernized buildings to maintain the engagement of students, staff, and the larger community. The energy dashboard is an unparalleled source of data about how the building is performing.

PLUG LOADS

Plug loads consist of the many and varied devices that are plugged into receptacle outlets in buildings. Plug loads can be controlled either with a management plan requiring human action or with a passive system where plug load devices are controlled by an automation system that removes human action from the equation (preferred). Staff refrigerators and microwaves should be provided to discourage individual units. Outlets wired for receptacle control (as per Title 24) shall be clearly labeled. HVAC systems should be designed to ensure appropriate thermal comfort with adjustability, and then thoroughly commissioned to ensure proper installation, to reduce the use of fans and portable heaters.

KITCHEN EQUIPMENT

Efficient kitchen equipment is required and must be all electric by 2045. The CA Energy Wise website provides equipment recommendations for kitchen appliances, walk-ins, and cooking hoods. Include commercial induction ranges for making school meals wherever possible. The Food Service Technology Center provides best practices on all-electric kitchens.

HEATING & COOLING

Heating and cooling shall be provided by HFC-free (when available), centralized, all-electric systems that meet CEE Tier 2 levels of efficiency. Projects should prioritize the removal of gas heating systems in existing buildings and NO gas heating systems are allowed in new construction.

VENTILATION

Mechanical ventilation should incorporate dedicated outside air systems (DOAS) with occupancy and/or CO2-based controls, a 15-minute delay, and MERV-13 final filters throughout. Fresh air should originate from a shaded/cool part of the building exterior and be delivered low in each space. Ceiling fans may be used to expand the comfort range and to allow for an increased cooling set point. Kitchen hoods should incorporate heat recovery and variable flow control and be designed according to CA Energy Wise Design Guides. Ventilation in single-occupancy restrooms should be tied into the local occupancy sensor.

Design teams should additionally consult the CDC recommendations for ventilation best practices to increase the delivery of clean air and dilute potential contaminants.

CONTROLS

Space conditioning controls should be tied into the District EMS systems and separate controls provided for each zone. Occupied hours vary depending on room (7AM-3PM for classrooms; 7AM-3PM for offices, etc.). The system should be off after hours, on weekends, and over unoccupied holidays (with the possibility of limited duration and zone-specific overrides).

- Set points should be 68 +/- 3 degrees F in heating mode and 78 +/- 3 degrees F in cooling mode for all new/modernized buildings
- Set points should be 68 degrees F in heating mode and 74 degrees F in cooling mode for all non-modernized buildings.

HOT WATER

Refer to the Advanced Energy Design Guide for K-12 School Buildings for domestic and service hot water. In addition, large kitchens with walk-in coolers/freezers should be outfitted with heat

recovery systems that preheat hot water. All pipes shall be insulated, and water temps set at <120 degrees F, except for commercial kitchen water temperatures.

RENEWABLES

Appropriately sized breakers, panel and conduit will be included in the base bid. Renewable energy system panels and equipment will be considered as an add alternate in new construction and major modernization construction projects. Projects will use the PV Watts Calculator to calculate the solar capacity for your project location and compare against the modeled energy use to correctly size the PV array.

ADDITIONAL CONSIDERATIONS:

WATER & IRRIGATION

Urinals shall use no more than one pint per flush and be installed with partitions in all male restrooms. Other fixtures shall meet the latest CalGreen requirements. Remodeled restrooms shall contain shut-off valves to aid in the identification and repair of plumbing leaks. Multi-fixture restrooms should be pre-plumbed to receive rainwater for toilet flushing. Drought-tolerant plants should be used (outside of food gardens), hose bibbs provided around the perimeter of buildings, and natural grass replaced with turf on athletic fields.

STORM & RAINWATER

Playground matting shall be permeable, and schoolyards should be graded to allow perimeter infiltration.

It shall be the goal of all new projects to capture and retain all stormwater runoff on site. To that end, all roofs shall be rainwater-harvesting friendly (TPO, metal) and incorporate external downspouts. Backflow devices are required at the point of collection and at the street. Finally, toilets at frequently used multi-stall restrooms should be pre-plumbed as follows (or retrofitted during gut modernizations):

- Toilets should be served by a dedicated water line that is labeled as a rainwater line (inside walls only).
- That water line should be connected to the local domestic water system.
- Design teams should create an accessible tie-in point where future rainwater can be routed into the toilet water line and a three-way valve added.
- Low impact development, like rain gardens, porous pavement, and bioswales shall be considered when appropriate.

MATERIALS

Finishes and other materials shall be durable, contain recycled/bio-based content, lead and PVC-free, recyclable at end-of-life, and meet low emissions criteria outlined in CalGreen and CA Section 01350. This applies to paints, coatings, adhesives, sealants, flooring/carpet, composite wood/panels, acoustical ceilings, insulation, and furniture.

EV and FLEET

EV charging capability shall be incorporated for a minimum of Level 2 Charging Infrastructure for 10% of the current parking spaces for staff and visitors. Additionally, the District plan to transition EV Fleet to Electric Bus should be made available to the design team to be able to appropriately incorporate bus charging infrastructure for future charging.

ACTIVE COMMUTE

Walking and biking routes on the school campus shall be planned to improve safety and encourage active commutes. Design teams will provide one bike rack (4-loops) for schools on hills and two bike racks or enough to meet demand (whichever is greater) at all other locations. Design teams will engage with external partners, including the city, to ensure active transportation friendly crosswalks and sidewalks are either maintained or included in the design.

SCHOOLYARD

Incorporate drought tolerant and biophilic landscaping wherever possible. Ensure the design is student and maintenance friendly.

- Shade tree plantings will cover at least 30% of each school property in the areas used by children and youth during the school day.
- Per Title 24, shade tree plantings will be required over at least 20% of the landscape area and 20% of the hardscape area within 15 years, with landscape irrigation necessary to establish and maintain tree health.
- Interactive gardens and outdoor classrooms should be considered at all elementary schools. The design should be student and maintenance friendly.
- Design schoolyards to protect students from extreme heat while also nurturing their development and growth. This means climate resilient schoolyards with nature play, outdoor classrooms, gardens, and pocket forests.