CLIMATE PARENTS | SIERRA CLUB

MOBILIZING PARENTS AND FAMILIES FOR CLIMATE SOLUTIONS

100% Clean Energy School Districts Handbook

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This handbook was produced by the Climate Parents and Ready for 100 programs of Sierra Club and was written by Katy Mamen and Lisa Hoyos. It was informed in part by the Ready for 100 publication, *Achieving an Equitable and Just Transition to 100% Clean, Renewable Energy: Guidelines and Recommended Actions for U.S. Communities*. We thank Jodie Van Horn, Kassie Rohrbach, Rachel Golden, and John Romankiewics at the Sierra Club for their contributions.

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About Climate Parents and Ready for 100

Climate Parents, a program of the Sierra Club, is a diverse national movement of parents and families mobilizing for clean energy and climate solutions. We work to influence leaders to implement policies that protect youth and communities from the health and climate impacts of burning fossil fuels and other human activities. Sierra Club's Ready for 100 program is a movement of people working to inspire our leaders to embrace a vision of healthier communities powered by 100% clean energy. Ready for 100 has already moved over 100 cities, from Atlanta to San Diego, to commit to 100% clean energy.

About our 100% Clean Energy School Districts campaign

Our 100% Clean Energy School Districts campaign builds on the 100% clean energy momentum being seen at the city and state levels. Through partnership with parent and student groups and other community allies (including Sierra Club's 64 chapters and more than 400 local groups), this campaign supports school districts across the country in powering with 100% clean, renewable energy. We believe that school districts are important leaders in the clean energy movement and have great potential to transform how energy is generated and consumed. Strategically, our campaign's primary focus is onsite energy; but there is ample opportunity to expand a school district's positive impact by including other areas such as school food and transportation.

How to use this handbook

This handbook is intended as a resource for school district staff and allies working to implement clean energy solutions. We have compiled many of the best resources on topics ranging from renewable energy solutions and energy efficiency strategies to financing options. If you're new to clean energy in the school district setting, we recommend that you read the handbook from beginning to end. If you are looking for more specific information or case studies, flip to the sections most relevant to you. The first part of the handbook makes the case for clean energy, which you may find useful in gaining support for, or communicating about, your efforts. The second half provides a step-by-step roadmap for achieving 100% clean energy districtwide. Many of these sections include resources, tools, and real-world examples that will help guide your efforts. Please be in touch with us at info@climateparents.org if you have any questions or if we can provide additional support.

Why 100% clean energy school districts matter!

Schools play a pivotal role in educating young people, academically and beyond. As we know, they model important societal values for students. Policies and practices around sustainability--and other key values like social justice and equity--can shape the kinds of communities that students will one day lead. These values are reflected in the reasons we believe that 100% clean energy initiatives are important and meaningful to students and the broader community. There are many significant benefits and opportunities created by moving school districts to 100% clean energy, including:

→ *Saving money and better resource teaching*

K-12 school districts spend $8 billion each year out of their general operating budgets on energy, a cost burden second only to personnel.[1] One of the most exciting effects of shifting to 100% clean energy is the potential for significant cost savings over time. It's estimated that energy efficiency measures alone could easily save U.S. school districts $2 billion per year, a full quarter of their energy costs.[2] Money saved in a district's general fund can then be reinvested more directly into students and classrooms. Also, a shift to renewables can minimize the anticipated financial risk of fluctuating energy costs.

Most schools with solar photovoltaic systems save money each year. The cost of installing school photovoltaic systems has dropped by ⅔ in the past decade.[3] In many places, it's possible for school districts to take advantage of sizeable incentives or to avoid upfront costs altogether, such as with a power purchase agreement. In most states, school districts can sell excess power back to the grid, especially in the evenings and over the summer when school district energy use is lower.

Heating and cooling typically represent the largest share of schools' energy bills, but

[1] U.S. Environmental Protection Agency. (2011). *Energy Efficiency Programs in K-12 Schools: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs.* U.S. Environmental Protection Agency State and Local Climate and Energy Program. Retrieved December 20, 2017, from https://www.epa.gov/sites/production/files/2017-06/documents/k-12_guide.pdf

[2] U.S. Environmental Protection Agency, 2011.

[3] The Solar Foundation, Generation 180 and the Solar Energy Industries Association. (2017, November). *Brighter Future: A Study on Solar in U.S. Schools, 2nd Edition.* Retrieved January 13, 2018, from https://www.generation180.org/solar-schools

schools can save on these costs and improve indoor air quality by switching from fossil fuel heating systems to high-efficiency electric or geothermal systems. → Creating healthier environments and improving academic performance

Clean energy school districts are able to provide healthier environments for our students, both inside and outside of school. We know that fossil fuel combustion is a major contributor to air and water pollution, causing respiratory illness, heart disease, and cancer. Outdoor air pollution is responsible for 3 million premature deaths each year, including a quarter of all lung cancer deaths and a significant portion of deaths from stroke, heart disease, and lower respiratory infection.[4] Asthma is one of the most common reasons that students miss school: In 2015, asthma caused 13.2 million missed instructional days;[5] African-American children are twice as likely to have asthma as white children;[6] and students in low-income areas are more likely to miss school because of asthma.[7] This disparity extends to Latinx children as well: Nearly 1 in 10 suffer from asthma, and Latinx children are 40% more likely to die from asthma than non-Latinx whites.[8] Teacher absences due to asthma and illness also impact academic performance.

High-performance school buildings, those designed for low impact on people and the environment by being highly energy- and resource-efficient, enhance wellness through tangible improvements in the temperature and quality of the air that students and staff breathe. Ample research has demonstrated a link between student academic performance and building conditions and facilities management. Cognitive function is significantly affected by building ventilation, carbon dioxide levels, and volatile organic compounds.[9] After socioeconomic status, the most important factor influencing student achievement is a controlled thermal

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[4] World Health Organization. (n.d.). *Ambient air pollution: Impacts.* Retrieved February 23, 2018, from http://www.who.int/airpollution/ambient/health-impacts/en/

[5] Eitland et al. (2017). Schools for Health: Foundations for Student Success. Harvard T.H. Chan School of Public Health. Healthy Buildings Program. Retrieved February 21, 2018, from http://schools.forhealth.org/Harvard.Schools_For_Health.Foundations_for_Student_Success.pdf

[6] National Center for Environmental Health. (n.d.) *Asthma's impact on the nation: Data from the CDC National Asthma Control Program*. Retrieved December 19, 2017, from https://www.cdc.gov/asthma/impacts_nation/asthmafactsheet.pdf

[7] Meng, Y., Babey, S.H., & Wolstein, J. (2012). Asthma-related school absenteeism and school concentration of low-income students in California. In: *Preventing Chronic Disease* 9:110312. Retrieved December 10, 2018, from https://www.cdc.gov/pcd/issues/2012/11_0312.htm

[8] Rosser, F. J., Forno, E., Cooper, P. J., & Celedón, J. C. (2014). Asthma in Hispanics. An 8-year update. *American journal of respiratory and critical care medicine*, Retrieved January 24, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4098086/

[9] Allen, J.G., MacNaughton, P., Satish, U., Santanam, S., Vallarino, J., & Spengler, J.D. (2015). Associations of cognitive function scores with carbon dioxide, ventilation, and volatile organic compound exposures in office workers: A controlled exposure study of green and conventional office environments. *Environmental Health Perspectives*. Retrieved May 9, 2018, from https://ehp.niehs.nih.gov/15-10037/

environment. While a comfortable temperature is important for students' ability to concentrate, poorly controlled temperature, inadequate ventilation, and inferior indoor air quality (e.g., moisture, mold) can worsen asthma and accelerate the spread of illness. With more students missing school, academic performance suffers.[10] Occupants of schools that are poorly ventilated suffer 50-70% more from respiratory illnesses.[11] In addition, gas appliances, especially stoves, are a primary source of carbon monoxide and other criteria pollutants that are hazardous to our health.

Energy efficiency measures such as daylighting (e.g., via tubular skylights and many other high- and low-tech modifications), other lighting upgrades, and ventilation enhancements can also improve concentration and wellness in youth.[12] For example, one study found that students in classrooms with sufficient daylighting had test scores 20-26% higher than those in traditionally lit environments.[13] Renewable all-electric heating and cooling, water heating, and cooking--along with a wide range of other energy efficiency measures—can significantly improve classroom air quality, which in turn reduces incidence of asthma and the spread of illness.

Outside of school, clean energy school districts contribute to improved air and water in the wider community by alleviating pollution from fossil fuel combustion. This leads to healthier families and conditions that promote higher levels of physical activity.

"We've had [geothermal] systems for almost two years, and I cannot say enough about the

[10] Mendell, M.J., & Heath, G. (2004). A Summary of Scientific Findings on Adverse Effects of Indoor Environments on Students' Health, Academic Performance, and Attendance. Prepared for U.S. Department of Education Office of the Under Secretary. Retrieved February 3, 2018, from http://iehinc.com/PDF/effects%20on%20students.pdf; and Eitland et al., 2017, and Earthman, G.I. (2002). *School Facility Conditions and Student Academic Achievement* [Electronic version]. Los Angeles, CA: UCLA's Institute for Democracy, Education, & Access (IDEA). Retrieved February 12, 2018, from http://mfc205.wikispaces.com/file/view/wws08-Earthman.pdf

[11] Lawrence Berkeley National Laboratory. (2013, May). Association of Classroom Ventilation with Reduced Illness Absence: A Prospective Study in California Elementary Schools. https://eta.lbl.gov/sites/all/files/publications/lbnl-6259e-association_of_classroom_ventilation.pdf. Cited in: New Buildings Institute. (2017). *Zero Energy Schools Zero Energy Stakeholder Engagement and Messaging*. Retrieved May 25, 2018, from https://newbuildings.org/wp-content/uploads/2017/10/GtZ_ZEStakeholderEngagement.pdf

[12] Loveland, R. (2017). Dreaming the future: How zero energy design can transform the school environment. *Green Schools Catalyst Quarterly, III*, 48-58. Retrieved May 23, 2018, from http://catalyst.greenschoolsnationalnetwork.org/gscatalyst/september_2017/MobilePagedArticle.action?articleId=1152429&app=false#articleId1152429

[13] Heshong Mahone Group. (1999, August 20). Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance. http://h-m-g.com/downloads/Daylighting/schoolc.pdf. Cited in: New Buildings Institute. (2017). *Zero Energy Schools Zero Energy Stakeholder Engagement and Messaging*. Retrieved May 25, 2018, from https://newbuildings.org/wp-content/uploads/2017/10/GtZ_ZEStakeholderEngagement.pdf

advantages they've provided our district financially and environmentally. We were trying to improve the learning environment for our students and staff by improving air quality. The installation of these systems allowed us to meet that goal." -Tad Everett, Superintendent, Sterling Public Schools, Illinois[14]

→ *Cutting carbon pollution and help address climate change*

K-12 schools emit as many greenhouse gases each year as 18 coal-fired power plants.[15] Schools can lower their emissions by 30% or more just through efficiency measures alone and can entirely offset their energy-related climate impacts with a commitment to 100% clean energy. School districts have a particular opportunity--and responsibility--to mitigate their climate impacts because climate change affects children disproportionately. Children are especially vulnerable to climate impacts due to their developing lungs and higher respiratory rates, and those in low-income households and communities of color suffer disproportionately from climate-related health impacts due to their closer proximity to major transportation hubs and sources of air pollution. These problems are further compounded by the inequalities and barriers faced by these communities, such as lack of insurance and access to affordable, quality health care; fear of deportation, preventing emergency room visits; and lack of transportation or inability to take time off work to seek medical care for the illnesses caused by air pollution. As the impacts of climate change are projected to grow over time, young people will remain most at risk.

→ *Fostering student clean energy and climate leadership and hands-on STEM education*

Schools are the training ground for tomorrow's innovators and problem-solvers. Clean energy schools demonstrate to students in a hands-on way that 100% clean energy is achievable. Energy efficient buildings powered, heated, and cooled with clean electricity provide meaningful opportunities for project-based learning across STEM disciplines and beyond.

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[14] Gsell, Lindsay. (2010, May 24). Geothermal systems are a breath of fresh air for Illinois school district. U.S. Department of Energy. Retrieved March 3, 2018, from https://energy.gov/articles/geothermal-systems-are-breath-fresh-air-illinois-school-district

[15] K-12 schools account for 7.7% of primary energy use in commercial buildings, that is 536 trillion btu out of 6,963 trillion btu (U.S. Energy Information Administration). 2015 commercial building sector CO2 emissions were 932 million metric tons (MMT) CO2 (EIA Monthly Energy Review July 2018), so K-12 was responsible for 72 MMT CO2. Note that this calculation uses two assumptions: 1) that K-12 schools have similar geographic distribution to all commercial buildings; 2) that K-12 schools proportion of energy use among fuels (electricity, natural gas, oil) is roughly similar to average of commercial buildings (checked using CBECS microdata which looks at number of buildings in the CBECS sample that use the various fuels). Emissions equivalencies calculated using EPA greenhouse gas equivalencies calculator.

Students who are part of clean energy project planning, installation, and ongoing monitoring learn about where energy comes from, how it is used, and the positive impact that energy efficiency improvements--like better HVAC systems--can have on indoor air quality and student health. For example, some schools have installed wind turbines in their courtyards or have energy-use tracking mechanisms in the school lobby as tools for classroom learning. Antelope Valley Union School District in California integrated its solar power system into the science and math curriculum using an online energy monitoring system, and students scored 60% higher on tests in these subjects following solar-focused lessons.[16]
Through the promotion of educational efforts aimed at creating behavioral changes, districts can lower energy consumption and reduce a school's carbon footprint. The Boulder Valley School District achieved more than 10% reduction in energy use across most schools through behavioral change alone by implementing their innovative Shared Savings Program, which uses an online dashboard to monitor each school's energy use and offers cash awards linked to each school's energy savings that can be spent by the school as it sees fit.[17] The Clean Energy Classroom document at the end of the document provides a list of selected curriculum resources for integrating efficiency and renewables into the classroom, and onsite renewable energy firms can often be contracted to incorporate educational components into projects.

School districts are beacons in the wider community, helping to build broader awareness and action on solar, wind, and geothermal projects. Those that commit to 100% clean energy are sending a message to cities and states that they can do the same. Districts also play a leadership role in helping those cities and states that have already made 100% commitments to implement their vision.

→ *Enhancing community resilience*

Schools often play a vital role in community response and recovery efforts during and after emergencies. Schools are the most frequently designated facilities for providing shelter for displaced residents, serving as gathering places and emergency staging areas, and distributing essential information and materials. According to the American Red Cross, schools accounted for more than half of all shelter sites during major disasters in 2017. Solar, when paired with battery storage, can enhance and strengthen the resilience of a school by helping to ensure that facilities and services remain up and running when widespread power outages occur.

Unlike traditional fossil fuel generators, which tend to be the default choice for back-up power, resilient solar and battery storage systems can keep critical loads, like lights, refrigeration, and outlets, powered during an outage without having to depend on often-limited access to fuel supplies; and they can operate continuously throughout the year to deliver energy savings to

[16] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.
[17] Boulder Valley School District. (2018). Conservation. Retrieved May 24, 2018, from https://sites.google.com/bvsd.org/energy/conservation?authuser=0

schools. While much of Florida remained without power during Hurricane Irma, 41 schools across the state opened as emergency shelters thanks to their solar and battery storage systems. In fact, one of the schools ran out of gas to power its backup generators but was still able to serve as a shelter powered solely by solar and batteries. The schools are part of Florida's SunSmart E-Shelter Program, which has equipped more than 100 public schools with small solar and battery systems.

Whether motivated by budget savings, healthier indoor environments, enhanced resilience, educational opportunities—or some combination of all four—more and more schools are beginning to explore the benefits of pairing solar with battery storage, benefits that can be passed along to their students and their communities.

There are many additional benefits of 100% clean energy school districts. Clean energy projects can knit a community together by providing a positive focal point for residents. They can create meaningful local jobs and broader local economic development opportunities. The solar and wind industries employ 476,000 Americans with meaningful work, and this number is growing rapidly: The solar and wind workforce increased by 35% and 32% respectively in just one year.[18] Another 1.9 million Americans have part- or full-time employment in energy efficiency.[19]

100% Clean Energy School Districts: Yes We Can!

The benefits of taking a stand for clean energy schools are undeniable. School districts are major energy users within the municipalities where they are located. As mentioned above, the fossil fuels used to power and heat K-12 schools across the country result in climate pollution equivalent to that emitted by 18 coal-fired power plants.[20]

Why set a 100% clean energy goal?

A commitment to 100% clean energy sets a bold, aspirational goal of transitioning all energy used by school district buildings to non-polluting, renewable energy. A 100% goal is achieved when the amount of clean energy brought into, or generated by, schools equals or exceeds 100% of the annual energy consumed within that school or district. Establishing a goal of 100% creates a strong and transformational vision for change and has been shown to be more highly motivating than setting an incremental target.

[18] United States Department of Energy. (2017, January). *U.S. Energy and Employment Report*. Retrieved June 1, 2018, from https://www.energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf

[19] Ibid.

[20] K-12 schools account for 7.7% of primary energy use in commercial buildings, that is 536 trillion btu out of 6,963 trillion btu (U.S. Energy Information Administration). 2015 commercial building sector CO2 emissions were 932 million metric tons (MMT) CO2 (EIA Monthly Energy Review July 2018), so K-12 was responsible for 72 MMT CO2. Note that this calculation uses two assumptions: 1) that K-12 schools have similar geographic distribution to all commercial buildings; 2) that K-12 schools proportion of energy use among fuels (electricity, natural gas, oil) is roughly similar to average of commercial buildings (checked using CBECS microdata which looks at number of buildings in the CBECS sample that use the various fuels). Emissions equivalencies calculated using EPA greenhouse gas equivalencies calculator.

As major energy consumers, school districts are well placed to help lead the way toward a 100% clean energy future. Their leadership in these efforts can be a solutions multiplier that would improve the health of the children and families they serve, help fight climate change, save schools money, advance STEM and sustainability education, and create meaningful local jobs. As the heart of our communities, schools should be clean, safe, and healthy places. Clean energy is essential to enable children to breathe clean air at school as well as in the wider community.

There is ample evidence that worldwide fossil fuel use can be eliminated by 2050 or sooner, including in the United States.[21] School districts can tangibly lead in our clean energy transition. If all schools switched to 100% clean energy, the effect would be equal to taking one in seven passenger cars off the road.[22]

A number of school districts have already achieved 100% clean energy, and many others have adopted strategies to move towards meeting 100% of their electricity and heating and cooling needs from renewable energy sources. San Francisco Unified School District and Boulder Valley School District are implementing plans to achieve carbon-neutrality at the school district level. A feasibility study by the National Renewable Energy Laboratory shows that zero energy schools—buildings with low energy loads that produce more energy through renewables than they use—are viable in every part of the country.[23] Already, K-12 schools make up almost a fifth of the roughly 500 buildings nationwide that are zero energy. Today, almost 5,500 schools, serving about 4 million K-12 students, are powered at least in part by solar. Notably, in just the last 3 years, the number of schools with solar power has increased almost 50%.[24] Together, solar schools produce 1.4 million MWh of electricity each year; that's enough to power more than 190,000 homes and offset about 1 million metric tons of carbon dioxide annually, the equivalent of the emissions from nearly 221,000 cars each year. Imagine what would be possible if *all* school districts committed to 100% clean energy!

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[21] See for example: CleanTechnica (n.d.). *70%, 80%. 99.9%, 100% Renewables--Study Central*. Retrieved February 10, 2018, from https://cleantechnica.com/70-80-99-9-100-renewables-study-central/

[22] K-12 schools are responsible for 72 MMT CO2, which is equivalent to 15,417,559 cars. This represents 14% of the 2016 fleet of 113 million automobiles registered in the U.S. (Source: Statista. (2018). U.S. automobile registrations from 2000 to 2016. Retrieved August 14, 2018, from https://www.statista.com/statistics/192998/registered-passenger-cars-in-the-united-states-since-1975/. As such, a shift to 100% clean energy in K-12 schools generates climate benefits equivalent to taking 1 in every 7 cars off the road.

[23] Bonnema, E, D., Goldwasser, P., Torcellini, S., Pless & Studner, D. (2016, November). *Technical Feasibility Study for Zero Energy K-12 Schools.* Washington, DC: National Renewable Energy Laboratory. Retrieved February 20, 2018, from https://www.nrel.gov/docs/fy17osti/67233.pdf

[24] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.

While interest is clearly growing, schools with solar power currently represent less than 5% of K-12 schools, and other clean energy technologies like wind and geothermal energy are in place at only a tiny fraction of schools. More than 100,000 schools today still rely exclusively on fossil fuels,[25] indicating that there is great potential to accelerate the adoption of clean energy and energy efficiency in school districts. On a positive note, as the pace of renewable energy in schools increases, there have also been some major strides around energy efficiency. For example, in 2012, California passed a ballot proposition that made available half a billion dollars a year over a five year peroid for energy efficiency retrofits at its public schools. Momentum is building.

A resolution in support of 100% clean, renewable energy by a school district can mark the beginning of a district's commitment to crafting a strategy that moves it off fossil fuels entirely. It serves as a call to action to motivate local stakeholders, build a common vision of the district's energy future, and spark increased awareness and action in the broader community. When school districts partner with other stakeholders–including cities and other large energy users such as hospitals–in the same utility service areas, together they can influence utilities to produce or procure cleaner energy.

Make the commitment: Pass a 100% clean energy school board resolution

Crafting a school board resolution is a great way for the district to formalize a clean energy commitment and provide its staff and supporters with the authority to implement its goal. In the municipal context, the Sierra Club has found that resolutions have been a powerful strategy for city councils to begin to power their jurisdictions with 100% clean energy. City officials across the country are now working with Ready for 100's grassroots campaign leaders to develop concrete plans to make their 100% commitment a reality. San Francisco Unified School District is one example of this at the school district level: The district's strong Resolution for Climate Neutral Schools has given way to a detailed plan that is now being effectively implemented.

We recommend that a 100% clean energy resolution includes the following core elements:

- *Specific date:* A target year for when this commitment will be achieved. The target year will vary according to several factors, and it may make sense to create a series of milestones for transitioning different elements such as achieving 100% renewable electricity by 2030 and shifting out of fossil fuels for heating, cooling, and cooking by 2040.

[25] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.

- *Clean and renewable resources only:* This includes carbon-free and pollution-free energy sustainably collected from renewable sources including solar, wind, and geothermal. Low-impact, small-scale hydro power and some forms of biomass may be included after being evaluated for sustainability and environmental justice implications. Nuclear, natural gas, coal, oil, or any other form of carbon-based energy production are not included in the definition of clean or renewable sources of energy.[26]
- *Commitment to energy efficiency:* Reducing the amount of energy used to power our school districts through energy efficiency is essential to making a complete 100% clean energy transition.
- *A focus on justice and equity:* A clean energy commitment is an opportunity to help enhance equity in your school district. For example, cost savings from transitioning to 100% clean energy can be reinvested into teachers and classrooms with a focus on creating more opportunities for students who are underserved. We recommend reviewing the concise, *Framework for an Equitable Energy Transformation.*[27]
- *Commitment to building-in clean energy and climate instructional opportunities for students* in the implementation process.
- *A transparent and inclusive planning and implementation process* ensures that all school community members have an opportunity to participate.
- *Commitment to building community resilience:* Given the number of school buildings that serve as emergency shelters, using energy storage to ensure that they are fully powered in times of need is a major community benefit.
- *Commitment to support more comprehensive climate action at the local, state and national level:* The resolution should acknowledge that through the action of moving to 100% clean energy, the district is taking meaningful local initiative, and it pledges to support additional measures to expand clean energy and climate solutions.

In addition, strong 100% clean energy school district resolutions should be developed alongside a stakeholder vision about what tangible implementation goals could look like for the first year and, ideally, within the first five years. This will help the district hit the ground running once the resolution is adopted. The model resolution in our 100% Clean Energy School Districts Organizing Toolkit offers a template that you can use or modify.

Having a strong resolution in place will create a solid foundation for implementation. The rest of this handbook addresses the various pathways school districts can take to achieve success and provides a range of important resources that can expedite the process.

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[26] For reference, you can find Sierra Club's complete energy policy at http://www.sierraclub.org/policy/energy

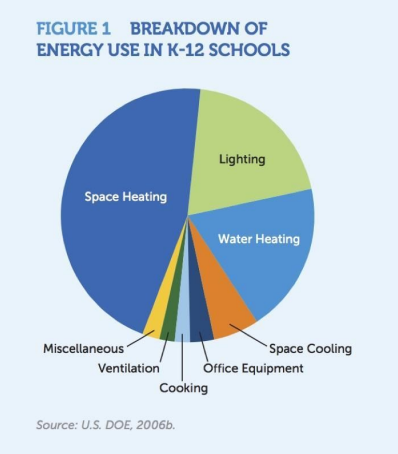
[27] Curti, J. and Wright, K. (2018.) *Framework for an Equitable Energy Transformation*. Meister Consultants Group. Retrieved January 14, 2019, from https://cadmusgroup.com/wp-content/uploads/2018/08/MCG_Framework-for-an-Equitable-Energy-Supply-Transformation.pdf?hsCtaTracking=e377801b-7a9d-49dd-a264-bcc67d5abab9%7C07ab34d2-6680-4f76-9322-94c41dcd8a3e

RESOURCES: Our model resolution (tool #7 in our Organizing Toolkit) includes the core elements outlined above. There are also additional school district clean energy-focused resolutions for your reference:

- San Francisco Unified School District's Resolution in Support of Carbon Neutral Schools
- San Diego Unified School District's Resolution to Support a Climate Action Plan including alignment with the city's objective of achieving 100% clean energy by 2035
- Boulder Valley School District's 2009 Environmental Sustainability Resolution, which includes greenhouse gas emissions reduction.

See also:

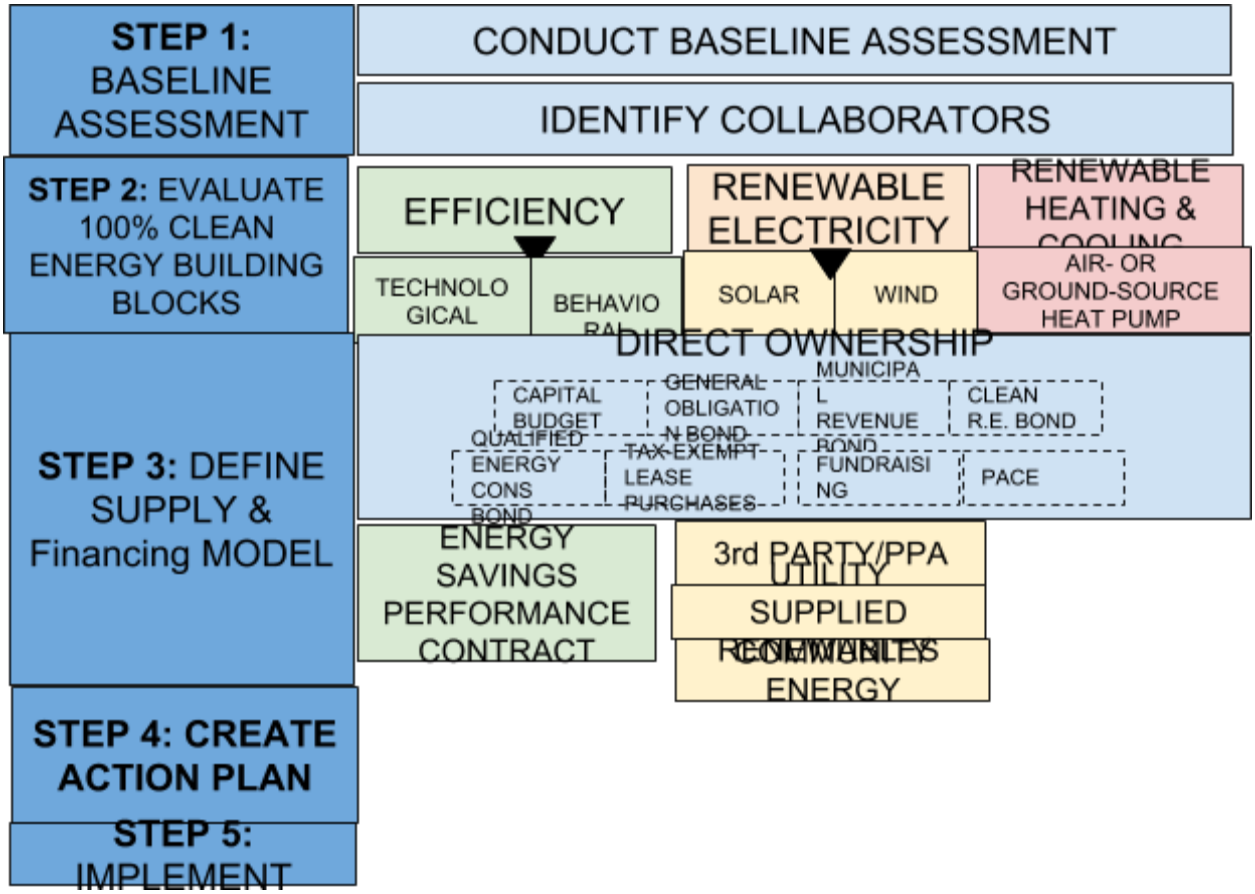
- Washoe County School District's Conservation and Sustainability Board Policy. This District created a regulation instead of a resolution. Contains renewable energy and efficiency measures (but does not have a 100% framework)
- Sebastopol Union School District's climate action resolution
- While not school district level, these city resolutions for 100% clean energy are a useful resource.



Pathways to 100% clean energy school districts

There are many viable routes that school districts can take to plan for and finance a shift to 100% clean energy. The best way forward for a particular district will vary according to factors like state policies, available incentives and technologies, and local conditions such as weather and appropriate installation locations.

School districts typically appoint a champion to take the lead in identifying pathways for moving to 100% clean energy. The facilities manager, energy manager, or sustainability director (where this position exists) will generally drive the process. Before taking action, the school district will benefit from a thoughtful and comprehensive review of the pathway that is the best fit for its circumstances and which evaluates the whole process, from early assessment through to implementation. Below are some important steps, along with key tools and resources, to help you successfully realize your 100% clean energy goal.



STEP 1: Conduct a baseline assessment

Before diving in, conduct a baseline assessment to map out and benchmark your current energy footprint and begin to identify what's possible and who can help.

(a) ***Understand your school district's energy picture.*** Assess the district's current energy use, costs, and fuel sources. While a district's energy use profile will vary according to climate and other factors, on average, heating and cooling account for about half of a school's energy use; lighting for about 20%; water heating for about 20%; and office equipment, cooking, ventilation and other uses make up the remainder (see Figure 1). Understand where fossil fuels come into the picture: Does your school district use gas or electricity for space heating and cooking? What are the sources of electricity in the portfolio of utilities serving the district?

Benchmarking is critical for understanding the school district's energy consumption as well as setting energy use intensity targets and reducing energy use down the road. Energy use

intensity (EUI) is a measure of annual energy use per square foot of building space, accounting for consumption from all fuel sources.

RESOURCES:

- ENERGY STAR benchmarking starter kit
- New Buildings Institute benchmarking resources
- NREL's *Technical Feasibility Study for Zero Energy K-12 Schools* and *Myths About Energy in Schools*
- See also the Zero National Forum's Zero Energy Schools Resources and the Zero Energy Buildings' Pathways to Zero Energy for new school construction.

(b) ***Build a collaborative effort***. A clean energy commitment provides a great opportunity for the school district and/or individual school community to come together to support a healthy future. The district staff, with whom you'll want to build relationships, will include the district's sustainability director (for those districts that have this position) and the facilities manager. You may also want to connect with the business office, chief financial officer, or even the superintendent. And, of course, it's important to partner in this campaign with parents, students, teachers, local nonprofits, and other stakeholders.

RESOURCE: Organizing Toolkit for 100% Clean Energy School Districts (produced by Sierra Club's Climate Parents program)

New Buildings Institute *Zero Energy Schools Zero Energy Stakeholder Engagement and Messaging*

(c) ***Understand your local and state clean energy regulatory and financing framework***. Peruse local, state, and federal policies and regulations that govern clean energy in your area. Build a basic understanding of the current laws in place to enable (or challenge) the transition.

RESOURCE: State Policy Opportunity Tracker (SPOT) for Clean Energy is a hub of information on existing state clean energy policies and, uniquely, future policy opportunities. It's a useful planning tool for school districts to get a snapshot of the policy context for clean energy in each state.

STEP 2: Evaluate the best clean energy building blocks for your district

While some schools may find that they can meet 100% of their electricity needs with a single approach, such as a large solar array, the majority will likely need a mix of approaches to achieve their 100% clean energy goal. Again, school districts will gravitate to different pathways

based on a range of factors. Experts often recommend proceeding with careful planning and in a particular order, referred to as loading order, so as to maximize both cost savings and success. The high performance buildings movement takes this approach, first advocating for deep energy reductions, employing energy use intensity (EUI) targets,[28] and then adding renewables to meet the remaining load.

However, a school district with high energy bills and low capital reserves may want to get started right away on meeting some of its needs through new solar arrays financed through power purchasing agreements (PPAs) while working to make energy efficiency gains. One school district may be able to install solar on roofs and over parking lots; whereas an urban school district, with tall school buildings and little parking, may look to a mix of onsite and offsite energy sources like community solar. As you read on, consider what pathway would work best for your school district.

The most critical building blocks to consider for existing school buildings include:

(a) ***Energy efficiency measures***, which can reduce a significant portion of a school district's total energy use;
(b) A shift to ***renewable energy*** to address the remaining energy footprint; and
(c) ***Renewable heating and cooling***, in particular *air-source or geothermal heat pumps* for heating and cooling and water heating needs. Most space heating and cooling and water heating is powered by oil and gas rather than electricity. Switching to high-efficiency renewable resources can significantly cut energy use, improve indoor air quality, and reduce climate pollution.

In addition to these larger pieces of the energy use pie, you can take other measures to expand clean energy and phase out fossil fuels, such as switching from gas stoves to induction burners—high efficiency stoves that harness magnetic energy and perform beautifully.

The key building blocks are covered in more detail below.BUILDING BLOCK 1: *Energy efficiency and conservation*

Reducing energy use by scaling up energy efficiency is an important step in transitioning to 100% clean energy. Many school districts have been able to reduce energy costs in existing schools by 30% through straightforward energy efficiency measures.[29] U.S. projects that have been verified zero energy use an average of 60% less energy than comparable buildings as a result of "careful design, aggressive energy targets, and careful building operation that typically

[28] See NREL EUI targets on p. viii of *Technical Feasibility Study for Zero Energy K-12 Schools* at https://www.nrel.gov/docs/fy17osti/67233.pdf
[29] U.S. Environmental Protection Agency, 2011.

includes operations and occupant education and engagement."[30] When planning and designing new school buildings, incorporating clean energy goals from the beginning can reduce the amount of energy used by up to 80%.[31]

How can your district's energy demand be significantly reduced? Technological strategies to enhance energy efficiency and savings may include, for example, lighting upgrades, weatherization, updating heating and cooling systems with more efficient versions (e.g., air-source heat pumps), building controls, and energy-efficient equipment. Schools can also pursue non-technical measures that enable behavioral shifts and create a culture of energy conservation behavior. Starting with energy efficiency can save the school district money immediately. Start with careful design to maximize benefits: Don't replace space heaters without also first considering building insulation, duct leakage, and thermostats.

RESOURCE: The ENERGY STAR* program created by the U.S. Environmental Protection Agency has developed a systematic approach for efficient energy management, including Portfolio Manager. This tool is ideal for school districts to help establish and verify energy use reduction goals, prioritize investments, and benchmark school energy performance against national standards. See also the EnergyStar* Schools for Energy Efficiency program, which encourages K-12 school energy efficiency through a structured behavior change campaign.

RESOURCE: ASHRAE's Achieving Zero Energy: Advanced Energy Design Guide for K-12 School Buildings

RESOURCE: Energy Efficiency Programs in K-12 Schools: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs.

RESOURCE: Powering Down: Behavior-Based Energy Conservation in K-12 Schools. This Center for Green Schools guide covers planning and design, implementation strategy, financing options, and case studies.

****100% Clean Energy in Action****

- Los Angeles Unified School District has implemented a wide range of energy conservation initiatives to achieve its goals of reducing its carbon footprint and offset a portion of its annual $100 million energy budget. The district's approach includes a strong educational component. Schools participating in the PowerSave energy conservation awareness program have saved $130,000/year on energy costs. The

[30] New Buildings Institute, 2018.
[31] Kanojia, M., 2017.

district has also implemented 21 MW of solar capacity, geothermal heating systems, and other measures.[32]

- Council Rock School District in Newtown, PA, created an energy management program in 2005 for its 12,000 students in 17 facilities. The district improved its energy performance by 40 percent across its entire energy portfolio within a few years, earning it recognition as an Energy Star* leader. These efforts helped the district reduce its annual CO_2 emissions by more than 7,000 metric tons, equivalent to taking 1,300 vehicles off the road.[33] These actions saved the school district $7.1 million over a 4-year period.[34]
- Richardsville Elementary School in Kentucky's Warren County Public School District was the first zero energy K-12 school in the country, achieving zero energy status in January 2012. The school implemented a range of strategies including efficiency in the thermal envelope, lighting strategies, centralized monitoring, and the installation of geothermal/ground-source heat pumps. The low energy footprint of the school contributes to the ability of the solar array to provide 27% more power than the school uses.[35]

BUILDING BLOCK 2: *Power up with clean, renewable electricity*

You can't achieve 100% clean energy without sourcing electricity from renewable resources. Solar is the most viable option for many schools in the United States, and it's also among the most appealing among clean energy solutions because of its affordability and accessibility. In some places, wind power is also worthy of consideration; and in certain contexts, other sources such as geothermal and tidal power can be a good fit.

(i) Solar. Solar is by far the most widespread source of clean electricity being adopted by school districts, powering 5% of schools nationwide and growing rapidly.[36] This growth is the result of solar's increasing affordability and ease of installation and management. Solar panels are readily available throughout much of the country, and a well-developed infrastructure exists to support contracting, funding, and implementation.

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[32] Los Angeles Unified School District. (2018). Energy conservation. Retrieved August 14, 2018, from http://learninggreen.laschools.org/energy-conservation.html

[33] U.S. Environmental Protection Agency, 2011.

[34] U.S. Environmental Protection Agency and U.S. Department of Energy. (n.d.). Council Rock School District, Newtown, Pennsylvania. Energy Star® Partner of the Year. Retrieved March 10, 2018, from https://www.energystar.gov/index.cfm?fuseaction=pt_awards.showAwardDetails&esa_id=3784

[35] Seibert, K.L. (2012, Fall). Achieving Net Zero. *High Performing Buildings*, 34-44. Retrieved December 1, 2017, from http://www.hpbmagazine.org/attachments/article/11817/12F-Richardsville-Elementary-School-Richardsville-KY.pdf

[36] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.

Many schools install as much solar onsite as possible to offset their power consumption, particularly in areas with a competitive rooftop solar industry where it's easy and cost-effective. In addition to rooftop solar, solar arrays can be installed over parking lots, providing the added benefit of shade. Some districts are installing ground mounted systems on unused or vacant land.

Learning about going solar is easy. There are many excellent resources to get you started.

TOOL: Estimate your buildings' potential for rooftop solar with EnergySage's solar calculator or Google's Project Sunroof.

RESOURCE: Filter by state through this list of available federal, state, and local solar incentives in the DSIRE resources database to see what your school district can qualify for.

RESOURCE: Several excellent solar report cards exist, rating states on solar policy and incentives and providing helpful information. These include the State Policy Opportunities Tracker Gap Analysis, Solar Power Rocks, and Freeing the Grid Best Practices.

RESOURCE: We also highly recommend, *Brighter Future: A Study on Solar in U.S. Schools* by the Solar Foundation, Generation 180, and the Solar Energy Industries Association. It's an excellent A to Z resource for learning about going solar at your school sites.

****100% Clean Energy in Action****

- One school district in North Carolina met 139% of its entire district's energy needs by installing standard-sized rooftop and standard solar systems on its 165 schools.[37]
- Broadalbin-Perth Central School District in New York will be offsetting 100% of its utility costs with a 2 MW offsite solar array.[38]
- Using a bond measure, Clovis Unified School District in California funded the installation of 5.9 MW via 19 individual photovoltaic systems. These will save the district about $2.7 million per year in energy costs.
- Read more case studies on solar in schools with Generation 180's solar stories.

[37] North Carolina Clean Energy Technology Center, North Carolina State University. (2016, February). Charlotte-Mecklenburg Schools Roadmap to 100% Renewable Electricity.
[38] Generation 180. (n.d.) Solar Stories. Retrieved April 1, 2018 from https://www.generation180.org/solar-schools-case-studies

Coupling renewable energy with energy storage
Adding storage capacity to a solar or wind project in order to capture energy for later use can bring a host of added benefits. The cost of batteries is dropping rapidly and is even becoming competitive with grid-supplied power and, so, is likely to add only incrementally to the capital cost of a renewable energy project. Benefits of battery storage include the ability to lower electricity costs by reducing peak energy demands when rates are higher and the ability to maintain power to critical systems during power outages or other emergencies, building resilience in the face of increasing climate and other disasters. It can also improve power quality and provide benefits to the grid like voltage control and enhanced integration of distributed energy supplies.[39]

Examples of schools coupling clean energy and battery storage can be found across the country. New Jersey's Hopewell Valley Central High School partnered with its electric utility to install a solar and battery system that allows the school to serve as a community cooling and warming station along with powering emergency lighting and food refrigeration. If an outage occurs in Rutland, Vermont, the emergency shelter at Rutland City High School will remain powered by large utility-owned solar and battery installation located nearby. The system is also saving the utility, Green Mountain Power, hundreds of thousands of dollars each year. In addition to allowing North Putnam Middle and High Schools in Bainbridge, Indiana to function as community shelters during grid outages, the schools' solar and battery systems are expected to save the school district around $8 million over a 20-year period. Kiosks located throughout the schools allow students to view an energy dashboard with information about how the systems are operating and how the school is using energy. In California, Santa Rita Union School District is expecting to meet up to 80 percent of its electricity needs with solar and battery storage while protecting the district from interruptions due to rolling blackouts, brownouts, or severe weather; and other California school districts are investing in solar and batteries based on savings alone, like Fresno Unified School District, which expects to save $27 million over 20 years with solar and battery storage.

"I have been working for years to get solar into our schools. With school budgets as tight as they are, going green was a very hard sell when the dollars would have to be taken from the classroom. [Our solar garden] was a wonderful project, one where I was able to tell our school board that we could make $7.7 million over the next 25 years and spend no district dollars! ($6.6 solar garden

[39] National Renewable Energy Laboratory. (2015). Distributed Solar PV for Electricity System Resiliency: Policy and Regulatory Considerations. Retrieved April 1, 2018, from https://www.nrel.gov/docs/fy15osti/62631.pdf. See also the Rocky Mountain Institute. (2015, August). The Economics of Demand Flexibility: How "Flexiwatts" Create Quantifiable Value for Customers and the Grid. Retrieved May 1, 2018, from: https://rmi.org/insights/reports/economics-demand-flexibility/

subscription & $1.1 land lease). What a wonderful way to help our district and the environment! Win-win for everyone!"
Kevin Johnson, Director of Buildings & Grounds - Red Wing School District[40]

Wind:

In some parts of the country, particularly in rural consolidated school districts, wind energy may be a good option. Several school districts have effectively implemented wind power projects. For many reasons outlined in Step 3 below, community wind projects serving multiple sites or utility-supplied wind power may be more attractive supply options for school districts than wind generated onsite.

Wind power is an important and exciting form of clean energy and has been a great solution for some school districts. It also presents some unique challenges for districts. While wind turbines range from small demonstration units to utility-scale turbines, there are in fact limited sizing options and it may be difficult for school districts to find the right size, whereas solar panels can easily scale to exactly match a district's needs. Some small school districts have turned to community wind projects serving multiple sites or utility-supplied wind power as an attractive supply option that can generate additional revenue. In addition, wind turbines tend to require more maintenance than solar panels, could see more opposition from neighbors, and may be subject to more restrictive zoning laws. Finally, while wind projects may benefit from financing mechanisms similar to those used with solar, such as power purchase agreements, these structures have not been as well developed. However, some simple policy advocacy could greatly facilitate financing for wind power.

TOOL: Consult the NREL wind energy maps and data or this map of best U.S. locations for wind power. Note that even if you don't fall within an area of high potential, it doesn't mean that wind power is not an option for you.

TOOL: Explore wind power projects at schools via this interactive map.

RESOURCE: Several helpful wind power development guides exist, including Windustry's Community Wind Toolbox and the U.S. Department of Energy's resources, Community Wind Energy Handbook and Small Wind Guidebook.

RESOURCE: Windustry's website contains helpful information and tools, including land leasing resources, business models, a permitting tool case, and more. Their Project Guide provides a good overview of the questions to address in considering the viability of a wind project in your school district.

[40] IPS Solar. (n.d.). Schools. Retrieved March 12, 2018, from https://ips-solar.com/schools/

RESOURCE: WINDExchange Regional Resource Centers exist to support local wind energy development projects. Contact the center nearest you for more information and support.

****100% Clean Energy in Action****

- The Spirit Lake Community School District in Iowa, with 1,300 students, installed two wind turbines in the early 1990s with a combined output of 1 MW, enough to cover about half of the district's total use. The total cost of approximately $1 million was primarily financed through no-interest loans as well as a $119,000 federal grant. The first turbine was paid off by 1998, three years ahead of schedule. The energy production on the second turbine significantly exceeds the value of the loan payments. It's estimated that the district saves $144,000 in annual electricity costs.[41]
- Eldora-New Providence Community Schools in Iowa created a community wind project in 2002. The district secured $800,000 of low- and no-interest loans and installed a 750kW turbine on the grounds of the district's high school. Eldora-New Providence negotiated an agreement with its utility to offset its electricity use District-wide with the turbine and sell any excess power back to the grid. The project was a success and remains in operation today, generating well over a million kWh each year and saving the District over $100,000/year in utility costs.[42]

BUILDING BLOCK 3: Renewable heating and cooling

While some space heaters, air conditioners, water heaters, and cookstoves are electric, many continue to be powered by fossil fuels. As a result, even if a school district is sourcing clean electricity, the district could still have a sizeable carbon footprint. Since space heating and cooling, water heaters, and cooking represent about three quarters of schools' energy use on average, renewable thermal technologies can be a big part of getting a school district to 100% clean energy. Simply replacing heating, ventilation, and air conditioning (HVAC) and water heating systems with more efficient electric technology such as heat pumps is an important way to save energy, reduce carbon pollution, and improve indoor air quality. If you are significantly shifting away from oil and gas to electric, be sure to account for the increased level of electricity use in any solar or wind planning.

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[41] National Renewable Energy Laboratory. (2012, July 31). Spirit Lake School District Case Study. Retrieved August 14, 2018, from https://www.nrel.gov/news/program/2012/1950.html. See also: Galluzzo, T. and Osterberg, D. (2006, March). *Wind Power and Iowa Schools*. The Iowa Policy Project. Retrieved January 18, 2018, from: http://www.iowapolicyproject.org/2006docs/060307-WindySchools.pdf.

[42] Windustry. (2014). Eldora-New Providence Community Schools Community Wind Project. Retrieved December 13, 2017, from http://www.windustry.org/resources/eldoranew-providence-community-schools-community-wind-project; And South Hardin Community Schools. (n.d.) ENP Wind Turbine. Retrieved January 11, 2018, from http://www.southhardin.k12.ia.us/client-showcase

Air-source heat pumps are gaining market share across the U.S., Europe, and Japan. They are typically 2-4 times more efficient than conventional water heaters and furnaces and are lower in cost than geothermal energy. Electric air-source heat pumps can also be programmed to heat water and can store hot water in tanks for later use. Heat pump space heaters can be split systems—heating classrooms individually—or can be ducted throughout the school and powered by a central system.

Geothermal heat is also an intriguing option for school districts and one that is gaining in popularity. Ground-source, or geothermal, heat pumps use pipes located underground to transfer heat from the ground to buildings in cool months and cooler temperatures from the ground to buildings in warmer months. Ground-source heat pump systems are a significant investment, but they pay for themselves over time and provide additional benefits such as excellent air quality.

There are other options as well. Evaporative cooling is a technology to consider in warm, dry climates. It employs the natural cooling of evaporation and uses about a quarter of the energy of a vapor-compression air-conditioning system. Small-scale biomass heating systems may be considered "clean energy" after being evaluated for public health, sustainability and impacts on local communities.[43]

Finally, gas stoves are a major source of indoor air pollution, particularly carbon monoxide and formaldehyde; so replacing them can benefit student health. Consider replacing gas and propane stoves with high-efficiency all-electric induction stoves.

Moving away from direct fossil fuel use may seem daunting upfront due to the cost and effort required, but these equipment retrofits can ease maintenance burden and leverage taxpayer funded bonds rather than burdening districts' operations budget. These projects at U.S. schools have typically been highly successful and are worthy of serious consideration.

RESOURCE: The U.S. Department of Energy provides a straightforward overview of air- and geothermal-heat pump technologies, selection considerations, and challenges.

RESOURCE: The Geothermal Exchange Organization has links to information and data, manufacturers, service providers, incentives, and more.

[43] More guidance can be found in: Sierra Club. (n.d.) Biomass Guidance. Retrieved May 1, 2018, from https://www.sierraclub.org/policy/energy/biomass-guidance

RESOURCE: The National Renewable Energy Laboratory provides a range of geothermal tools, resources, and maps that show the potential for direct use and deep geothermal systems where your school district is located.

****100% Clean Energy in Action****

- Mark Day School in San Rafael, CA constructed a new Learning Commons building that included a digital classroom, maker labs, and school administrative offices. It is an all-electric building using no fossil fuels and provides space heating with an air-source heat pump and water heating with an electric water heater. In addition, the school is procuring solar power using a power purchasing agreement that will provide sufficient energy for the new building and the rest of the campus.[44]
- Sterling Public School District in Illinois installed geothermal heating and cooling units in two schools and saw their *total energy use* decrease by 60% and 40% respectively at these schools. They entirely eliminated their need for natural gas.
- Fond du Lac High School in Wisconsin installed a geothermal heat pump that will save 25-40% of the school's energy costs.[45]
- In Lincoln, Nebraska, four schools installed geothermal heat pumps and found they used approximately 26% less source energy per square foot of floor area. Energy costs at schools with geothermal heat pumps in Lincoln, NE were half as much (per cooled-square foot) than schools with gas heating and water-cooled chilling systems. Geothermal systems also had a lower life cycle cost than conventional space-conditioning systems.[46]
- Lady Bird Johnson Middle School in Irvine, TX installed 107 closed loop geothermal heat pumps. Overall energy use from the heating, cooling, and ventilation system was reduced by 30%.[47]

STEP 3: Define supply model and financing mechanisms

Energy efficiency and renewable energy projects can save a school district real money over time and in some cases can have immediate payback. While there can be upfront capital investment issues to navigate, there are good mechanisms to address these challenges and a wide variety of available incentives.

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[44] Scott Shell, EHDD, personal communication, March 20, 2018.
[45] CD Smith Construction, Inc. (n.d.) Fond du Lac High School. Retrieved December 12, 2018, from http://www.cd-smith.com/projects/fond-du-lac-high-school
[46] Shonder, et al., 2000.
[47] DFW Solar Tour. (2017, October 7). Lady Bird Johnson Middle School. Retrieved January 8, 2018, from http://www.dfwsolartour.org/locations/ladybirdjohnsonmiddleschool/

Self-financing options may include establishing a green revolving fund—a special dedicated account for energy efficiency and sustainability projects—or seeking grants, loans, or bond funding such as a Qualified Energy Conservation Bond (QECB). Incorporating solar requirements into bond language at school campuses can be very effective and important. See Appendix 3 in *Brighter Future: A Study on Solar in Schools*[48] for more information on general obligation bonds, municipal revenue bonds, clean renewable energy bonds, and qualified energy conservation bonds.

In addition, there are several sources of support for energy efficiency projects as described in the resources below. Your utility is also a good place to check for energy efficiency programs that provide incentives.

Energy savings performance contracting. An energy savings performance contract (ESPC) is a way to advance energy improvements without impacting the district's budget by using future energy savings to pay for facility upgrades. In this approach, a third party called an energy service company (ESCO) will evaluate current energy use and propose turnkey efficiency and conservation measures that will save money and provide an assurance of energy saved. The ESCO will typically retain a portion of funds saved through efficiency measures as payment for its services. ESPCs are often used for energy efficiency projects; but they can also include solar or wind power purchasing agreements, the energy services company serving as the third party.

There are several helpful resources and guides to facilitate school district decision making about financing clean energy projects:

RESOURCE: DSIRE is the most comprehensive source of information on incentives and policies that support renewables and energy efficiency in the United States. You can look here to find existing incentives that will help you take advantage of opportunities for energy efficiency and renewables. http://www.dsireusa.org/

RESOURCE: Center for Green Schools' Paid-from-Savings Guide to Green Existing Buildings is a great resource for facilities managers to maximize project savings and leverage utility cost savings to fund comprehensive green building improvements.

RESOURCE: Green Schools Investment Guide explains energy efficiency opportunities for each building system and covers a wide range of considerations for energy efficiency, renewables and more. In particular, see more information about Efficiency Services Agreements in the "Finance & Implementation Strategies" section.

RESOURCE: Energy Savings Performance Contracting: A Primer for K-12 Schools covers best practices for school districts engaging in ESPCs. See also the Energy Services Coalition 5 Steps to

[48] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.

Successful Energy Performance Contracting. If you're weighing an ESPC versus self-financing, this Energy Services Performance Contract Toolkit may be of service.

RESOURCE: State Level Legislation to Support Energy Efficiency: Dedicated Funding for Existing K-12 Schools (2017) outlines energy efficiency policies and programs specific to schools. While it was primarily created for legislators, it will give school districts a good understanding of relevant policies and funding in your state.

RESOURCE: U.S. Office of Energy Efficiency and Renewable Energy Qualified Energy Conservation Bonds Solution Center.

Financing models for renewable electricity projects

There are a range of procurement and financing models for renewable electricity projects. Clean energy supply models include direct ownership of renewable energy systems, third-party ownership of renewable energy systems, shared procurement of renewable energy, and utility-supplied clean power. The majority of school districts make use of the first two options--direct ownership and third-party ownership. Each of the avenues is described below along with relevant financing pathways. A summary of all mechanisms is included at the end of this document.

Because school districts don't directly qualify for federal or state tax credits, financing renewable energy projects can be challenging. Many districts that have successfully self-financed their solar power projects have done so by combining direct cash outlays (through bonds and capital and general funds) with other financial support such as grants, loans, and rebates.[49]

Financing for resilient power
A range of low-cost financing mechanisms for clean power plus storage projects are available. CleanEnergy Group's Clean Power Project and their publication, *Resilient Power: Financing for Clean, Resilient Power Solutions* is a guide to financing considerations and solutions that is a helpful resource for school districts investigating options for resilient power.

(a) Third-Party Ownership and Power Purchasing Agreements (PPAs)

Third party ownership of solar and wind projects is particularly popular because it typically eliminates upfront costs for a school district. The most popular framework is a power

[49] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.

purchasing agreement (PPA). In the past three years, almost 90% of new solar projects at schools (for which data are available) have been implemented through PPAs.[50] In PPAs, a third-party renewable energy provider will build, own, operate, and maintain a renewable energy system (photovoltaic, solar thermal, wind, etc.) on behalf of the school district. The school district will typically host the system onsite, providing the site (rooftop, parking lot, or other location) and purchasing the electricity from the provider for a set period of time. PPAs can also be employed for wind energy projects, but this is not yet widely practiced. PPAs are a great model for school districts because:

- There is little or no upfront cash investment;
- There is low risk involved and predictable electricity costs over time;
- The district doesn't have to manage maintenance and operations;
- They allow the district to take advantage of tax credits and some additional incentives that it would not otherwise have access to as a tax-exempt entity; and
- School districts can invest saved energy expenses to support other pressing needs that benefit students more directly.

In addition to PPAs, other forms of third party participation can help take advantage of incentives and facilitate financing for the project. Some of these mechanisms include:

- **Partnership flip.** The school district partners with an investor who can take advantage of the tax incentives and create a special purpose entity to own and operate the project. The investor will receive the majority of financial benefits until a certain return is met, at which point the allocation of majority ownership and benefits flips to the school district. This structure has, as an example, been employed widely in North Carolina, in partnership with over 100 solar farms and has been projected to secure an average of about $259,000 in savings for each school operating on 100% clean electricity.[51]
- **Sale/leaseback.** The school district installs the solar array but then sells it to an investor and leases it back. This investor then receives both the tax benefits as well as lease payments. The school district, while being responsible for maintenance and operational costs, can avoid the upfront costs and may be able to buy back the array at fair market value when tax benefits run out.
- **For-profit partnership.** The school district partners with a tax-motivated investor who can take advantage of the tax credits and can structure the project as a business. A range of business entities may be appropriate, depending on the state and project type.

In order to take advantage of a PPA, your state must allow third-party ownership of distributed renewable energy resources. The following tools and resources can help school districts evaluate whether a PPA is right for them.

[50] The Solar Foundation, Generation 180 and the Solar Energy Industries Association, 2017.
[51] North Carolina Clean Energy Technology Center, North Carolina State University, 2016.

TOOL: This map indicates states that permit 3rd party solar PPAs. PPAs are currently only clearly enabled in certain states: AZ, AR, CA, CO, CT, DE, GA, HI, IL, IA, LA, MD, ME, MA, MI, MS, NV, NH, NJ, NM, NY, OH, OR, PA, RI, TX, UT, VT, and VA. They are also permitted in DC and Puerto Rico. Many other states have unclear statutes--for example, states that have authorized PPAs may not have done so in all jurisdictions. Some of these states, like MN, have made great strides in solarizing school districts despite restrictions in some parts of the state. The landscape is changing fast, so be sure to check the map for the most up to date information.

TOOL: Specific state policies on power purchasing agreements are listed on the National Conference of State Legislatures website.

RESOURCE: National Renewable Energy Lab checklist for PPAs.

RESOURCE: Solar Energy Industry Association factsheet on PPAs.

(b) Direct ownership and installation

Self-financing can be a good option if your district has the opportunity to fund distributed solar, or wind projects through your capital budget. While it can take more work and be subject to greater risk, owning your own power generation system typically leads to the greatest overall financial savings. You can seek funding from a bond measure (as described above) and take advantage of available federal, state, local, and utility-supplied incentives to help ensure optimal cost-effectiveness. Many other creative models exist to finance your clean energy projects. Direct ownership is more attractive in places with available incentives and a supportive regulatory context. Here are a few resources to help you assess these factors in your area.

RESOURCE: State incentives for renewable energy: DSIRE is the most comprehensive source of information on incentives and policies that support renewables and energy efficiency in the United States. http://www.dsireusa.org/

RESOURCE: Solar Schools Assessment and Implementation Project: Financing Options for Solar Installations on K-12 Schools. National Renewable Energy Laboratory (2011)

RESOURCE: If interested in pursuing wind energy, the NREL Wind for Schools funding spreadsheet gives sample costs and funding mechanisms from implemented school projects.

****100% Clean Energy in Action****

- A financial feasibility analysis at Nutley Public School District in New Jersey showed that an 870 kW photovoltaic system (covering 5 elementary schools and 2,042 elementary

students) would cost $3.64 million while providing $563,000 in energy savings and renewable energy credits per year, meaning the system would be paid off in 6.5 years, after which point it would fully offset $130,000 in annual energy costs.

WHAT YOU NEED TO KNOW ABOUT NET METERING
Solar and wind projects pencil out better if **net metering**—or special tariffs—are in effect in your state. About 40 states have mandatory net metering rules. Net metering allows the school district to be compensated for excess power it generates and delivers back to the grid. If your state and utility support net metering, this can represent a significant net discount on energy bills. Some states (CA, MA, and ME at the time of writing) enable virtual, or aggregate, metering. Virtual net metering allows renewable energy projects to credit the energy produced to multiple accounts in the utility's territory. It adds flexibility and works well for entities with multiple sites and, so, is great for school districts.

Some states establish **feed-in tariffs**, which guarantee to anyone who generates electricity from renewable energy a fixed price for the surplus power being sold back to the grid. This price tends to be set at higher-than-typical market rates to enable a reasonable profit. This could help a district more readily finance investments in renewables and reliably project expenses over a long period of time.

TOOL: Free the Grid has state-specific information about net metering and interconnection practices. See their state report card for important details on your state's current policy and practices.

TOOL: DSIRE's State-by-state map of net metering policies, which is updated quarterly.

(c) Community energy

Community energy models allow users to leverage their collective power to implement solar or wind power solutions. Two models—community choice aggregation and community renewables—are especially relevant for school districts.

Community choice aggregation (CCA): CCA allows local entities to pool (or aggregate) their electricity load in order to purchase and/or develop power on behalf of their residents, businesses, and municipal accounts. CCA is an energy supply model that works in partnership with the region's existing utility, which continues to deliver power, maintain the grid, and provide consolidated billing and other customer services. Historically, local governments have pursued CCAs in order to secure lower electricity rates for their residents. Recently in California, CCA programs have launched that offer both lower rates and a cleaner electricity mix than what is offered by the existing utility. CCAs are currently legal in CA, NJ, IL, MA, OH, RI, and NY, and

are under consideration in MN, DE, and UT. School districts can host renewable energy projects for community choice programs onsite. Districts can also take advantage of CCAs to opt in to the program's 100% renewable option, if available. The following resources will help you identify community choice opportunities in or near your district.

RESOURCE: The Local Energy Aggregation Network has more information on community choice aggregation.

RESOURCE: National Conference of State Legislatures list of CCA state policies (last updated 2015)

RESOURCE: Community and shared solar website of the Solar Energies Technology Office at the U.S. Department of Energy

Community renewables: Community solar or wind projects are energy systems that are owned by multiple entities and/or deliver power or financial benefit to multiple parties. School districts can join forces with others in the community to enable larger-scale power projects and potentially save even more. Community solar/wind is also a model that can be leveraged to provide clean power to low-income neighborhoods. Community renewable projects, and even projects that just serve the school district, can employ creative financing structures to fund them.

RESOURCE: A Guide to Community Solar: Utility, Private, and Non-profit Project Development

****100% Clean Energy in Action****

- Red Wing School District in Minnesota achieved 100% clean energy by installing a 6 MW solar array on a parcel of land they owned adjacent to a school and launching a community solar gardens project. The school district is set to save approximately $6 million in energy costs over a 25-year period and an additional $1 million in lease revenue from other energy customers receiving power from the project. The district has also implemented STEM curricula offered by the installer, IPS Solar.
- The City of Lancaster, California has been aggressively pursuing zero energy status. The Lancaster School District has been a key partner in the Solar Lancaster project and other alternative energy initiatives. In 2015, the district enrolled 41 accounts in the Lancaster Choice Energy program, bringing the district over $41,000 in net savings in just the first five months.[52] Lancaster and nearby Eastside School Districts recently installed 7.5 MW

[52] Lancaster Choice Energy. (2016, March 17). City of Lancaster Recognizes Lancaster School District as Key Partner in Pursuit of a Greener Tomorrow. Retrieved November 20, 2017, from http://www.lancasterchoiceenergy.com/2016/03/17/city-of-lancaster-recognizes-lancaster-school-district-as-key-partner-in-pursuit-of-a-greener-tomorrow/

of solar parking shade structures that together will generate $20 million in revenue over the life of the project.[53]

(d) Utility Supplied Options

Most electric utilities in the U.S have invested in some degree of renewable energy, and many are mandated by state renewable portfolio standards to transition a medium to large percentage of their energy portfolio to renewable resources. School districts are typically a large customer of the utility and, therefore, have leverage to push the utility to pursue more ambitious renewable energy investment plans, either alone or in partnership with other local school districts. School districts receiving utility-generated renewable energy electricity may be able to account for this in their 100% clean energy plan.

In places where school districts aren't able to put a PPA in place, utilities may offer dedicated "green tariffs" where the utility develops renewable energy sources specifically for these customers. Some areas may also provide "direct access tariffs" which enable school districts and others to procure power from independent renewable energy suppliers rather than from their utility.

About RECs: A Renewable Energy Credit (REC) is a market-based tool representing the ownership of the environmental benefit and other attributes of the energy generated through renewables sources. RECs can be bought by entities other than the one that produced the renewable energy, at which point it becomes "unbundled" from the energy generator and can be sold to a new "owner" who can claim the environmental benefit of the renewable energy produced.

We do not recommend Unbundled Renewable Energy Credits (RECs) as an investment primarily because RECs do not provide a potential for energy-costs savings, local job creation, or a guarantee of new renewable energy generation. However, if a district does purchase RECs to offset the current electricity mix, you should ensure that the RECs meet the EPA's guidance on purchasing RECs and are from projects that create "additionality," which means they are adding new renewable generation that did not exist prior to the commitment. When other investment pathways become available, we advise to phase down the purchase of RECs over time and replace them with direct investments in renewable energy projects as quickly as possible. In addition, if you are doing onsite renewable energy generation, we recommend that you retain your RECs rather than sell them in order to claim the environmental benefits of your project.

[53] Go 100%. (n.d.). Lancaster: Net zero power city by 2020. Retrieved August 18, 2018, from http://www.go100percent.org/cms/index.php?id=92&tx_ttnews%5Btt_news%5D=181&cHash=ce0be9725a292ac373baf02cc04860b1

STEP 4: Formalize an action plan

At this point in the process, you have a basic understanding of the clean energy terrain and may have some ideas about what pathways make the most sense for your school district. The district will want to seriously evaluate its options and create a roadmap for implementation, likely in the framework of a facilities master plan, energy master plan, capital renewal plan, resiliency plan, or whatever framework the district prefers and/or utilizes. A comprehensive master plan can also facilitate the bundling of financing for the activities. The plan should include:

- energy performance and clean electricity targets for all school buildings;
- the measures needed to achieve these targets;
- the supply and financing models to be employed; and
- key people responsible for managing implementation.

Now is an important time to engage stakeholders in the process. Consider creating an integrated design process that brings people together with a range of skill sets to develop collaborative design strategies that meet a diversity of concerns and builds buy-in.

This is also a great time to learn about the fantastic sources of free assistance that exist! There are many people and entities who are available to answer questions and help you understand your options. In particular, nonprofit groups, municipal or state energy experts, clean energy companies, and utilities that support clean energy can all be great sources of support.

(a) Nonprofits. There are many nonprofit organizations dedicated to healthy schools and clean energy. Check to see who is active in your area. A few key resources:

- Sierra Club's Climate Parents program would like to work with you and your school district in getting on the right track. Contact: info@climateparents.org. This is our main focus, so please reach out to us in addition to other non-profits that may be of interest.
- Generation 180's Solar Schools Campaign supports schools across the U.S. implementing solar power projects.
- The Center for Green Schools at the U.S. Green Building Council can advise on school-focused efforts around the country, and they have a range of helpful resources.
- The Collaborative for High Performance Schools is leading a national movement to improve student performance and the entire educational experience by building the best possible schools.
- KyotoUSA's HELiOS project supports districts in developing and implementing a solar master plan to eliminate electricity costs and implement renewable energy systems. See for example the Novato Unified School District Solar Master Plan.

- If your school or school district is considering going solar, check with the Solar Foundation (info@solarfound.org) for technical assistance resources tailored to schools.

(b) Public agency experts. Some municipal and state governments have free consultation services, in particular your state's Department of Energy.

(c) Clean energy firms. Energy, engineering, and architectural firms can pull together a quote and crunch the numbers for a variety of scenarios. See, for example, the Nutley School District presentation that was put together by an engineering firm. Be sure to identify a reputable firm in your area. Your local municipal, county, or state energy office may be a good resource for identifying well-respected companies. In lieu of a self-directed planning process, your school district may opt to outsource with an energy savings performance contract (see p. 15 for more information).

(d) Utilities. Contact your utility to learn more about their energy portfolio and programs to support energy efficiency and renewable energy. Utilities typically have experts who will assist with groundwork such as planning, prioritizing, energy efficiency analyses, and engineering assessments.

RESOURCES:

- See the San Francisco Unified School District's Carbon Reduction Plan
- Boulder Valley School District created a Sustainability Management System and subsequent Sustainable Energy Plan.
- New Buildings Institute's Getting to Zero: Zero Energy Integrated Design Charrette Toolkit for Schools
- The Collaborative for High Performance Schools' Planning for High Performance Schools best practices manual
- New Buildings Institute's Getting to Zero: Zero Energy Project Guide. A process for planning, designing, constructing, and operating your new zero net energy building. Includes a project checklist of key actions to take along the way.

STEP 5: Implement your shift to 100% clean energy

"Measure twice, cut once" is the carpenter's rule… and that goes for transitioning to 100% clean energy, too! Getting a plan in place is an essential part of the work. Once the pathway and financing are clear, making the shift to 100% clean energy is much more straightforward. We want to highlight a few important pieces to remember as you put your plan in place:

(a) **Contracting.** Minimize risk by having strong and thorough RFPs and contracts. Consult NREL's Renewable Energy Contract Development Best Practices page for a range of helpful resources and a PPA template. See the Solar Foundation's Steps to a Successful Solar Request for Proposal, the more detailed NREL's Power Purchase Agreement

Checklist for State and Local Governments, and NREL's Using Power Purchase Agreements for Solar Deployment at Universities. If you are advancing a wind energy project through a third party, consult the Community Wind Toolbox resources on power purchase agreements.

(b) **Operations and maintenance.** Keep systems in good operating condition to optimize performance as well as energy and cost savings. Replacing HVAC systems that run on fossil fuels with cleaner and more efficient systems, such as air- or ground-source heat pumps, should streamline maintenance needs. The U.S. Department of Energy developed a Guide to Operating and Maintaining Energy Smart Schools that can help districts dial in their O&M.

(c) **Community**. Think about creating a communications plan and raising awareness in the broader community about what you're doing--it's exciting and a great way to showcase the school district's great work as well as spark more interest in clean energy adoption in local neighborhoods and businesses. Remember to contact info@climateparents.org. We can help!

(d) **Monitoring and verification**. Be sure to track and monitor the actual energy savings of the measures you're putting in place. Engage teachers and classes at the schools in tracking progress. It's important to make sure that any commitments made by contractors are being met. Verification through programs such as The Collaborative for High Performance Schools or the New Buildings Institute verification of zero energy buildings will help you demonstrate your progress.

(e) **Commissioning**. Commissioning is a process used to assure the quality of the building's design, construction, and operation. The goal is to produce structures that meet the needs of their owners and occupants, operate efficiently, and provide a safe and comfortable environment. This quality assurance process should be applied to ensure that energy efficiency and renewable energy projects are being implemented correctly. Are they delivering as promised? Are energy savings being maintained over time?

Teaching the next generation. As highlighted earlier, one of the exciting benefits of a shift to clean energy in schools is the opportunity to integrate sustainability education and STEM into the classroom and to help students learn about climate solutions in a very tangible way. Below are some of the many wonderful teacher resources used to assist in connecting your school district's clean energy efforts with the curriculum.

CLEAN ENERGY IN THE CLASSROOM

Clean energy projects offer fantastic opportunities for real-world, project-based student learning. We recommend building in a strong educational component from the beginning, being sure to design your projects in ways that engage students, such as placing electricity monitors where students can observe them. There are many wonderful curriculum resources on clean energy--here are just a few to get you started.

- Learning Lab is USGBC's online education platform for K-12 teachers and school leaders to find lessons, activities, and resources that encourage student leadership, sustainability literacy, and real-world action.
- National Solar Schools Consortium's Curriculum and Educational Resources
- National Energy Education Development (NEED) Project's curriculum resources
- National Renewable Energy Laboratory educational resources
- Green Schools National Network's PD Collaborative provides support for sustainability pedagogy and curriculum design
- Green Schools Alliance's Resource Center
- Wind power curricula resources include KidWind's teaching tools and resources and Wind for Schools' curricula for elementary, middle, and high schools
- Schools and climate change curriculum resources include Our Climate, Our Future, from the Alliance for Climate Education, and Eco-Schools USA's school climate change audit and high school curriculum, Energy and Climate Change: Pathways to Sustainability

Conclusion:

We hope this handbook is useful to you as you work to build a better future for your students and schools, your community, and the planet. Climate Parents would love the opportunity to partner with you in making the transition to 100% clean energy a reality in your school district. We can help provide guidance as well as connect you with district facilities and/or sustainability directors around the country with whom you can compare notes. From saving money that can be reinvested into classrooms and improving indoor air quality, to demonstrating climate leadership and expanding community resilience, there is so much to be gained. Please reach out to us at info@climateparents.org. Let's do this!

TABLE: Clean energy options for school districts

OPTION	Description	Ownership	Financing required?	Availability (at time of writing)	Location of energy generation	Local job generation	Ease of operation and maintenance	Certainty of rates over time and general stability
THIRD-PARTY OWNERSHIP								

Power purchase agreement	A third-party energy provider builds, owns, operates, and maintains a renewable energy system on behalf of the school district. The district will typically host the system and purchase its electricity for a set period of time.	Equipment is owned, operated, and maintained by the energy provider. The school district owns the power generated.	No	Only in certain states: AZ, AR, CA, CO, CT, DC, DE, GA, HI, IL, IA, LA, MD, ME, MA, MI, MS, NV, NH, NJ, NM, NY, OH, OR, PA, PR, RI, TX, UT, VT, VA. Some other states have unclear statutes.	Onsite or nearby	Staffing of local energy provider	No O&M required	The school district pay xed rate for energy oduced via the renewab ergy project for a fixed iod of time.
Solar lease	Like a PPA, but the system is rented/leased in exchange for use of the system and its power rather than purchasing power from energy company.	Equipment is owned, operated, and maintained by the energy provider. The school district owns the power generated.	No	Same as PPA, above	Onsite or hosted nearby	Yes	The school district is responsible.	Fixed rate, typically in 20 year terms
Direct access tariffs	Permits certain classes of customers to purchase power directly from competitive renewable energy suppliers rather than from their utility. Utility transmits and distributes power.	Utility or utility subcontractor owns the infrastructure .	No	Applies to regulated and unregulated markets	Utility-pro vided; centralized	Case-by-c ase basis	No O&M required	[is
DIRECT PURCHASE								
Direct purchase of renewable	The school district takes bids from	The equipment is owned,	Yes	Anywhere the desired technology	Onsite or hosted nearby	Yes	Ongoing O&M required by	No guarantee unless gotiated with utility

energy system	installers and directly invests in renewable energy technology.	operated, and maintained by the school district.		is available			school district staff	
SHARED POWER								
Community solar	Solar P/V program providing power to, or owned by, multiple community members. May alternatively be utility-sponsored	Owned, operated, and maintained by a nonprofit, special purpose entity, or utility	No		Onsite or hosted nearby	Yes	No O&M required	[
Community Choice Aggregation	Allows local governments to pool (aggregate) their electricity load in order to purchase and/or develop power on behalf of their residents, businesses, and municipal accounts. The region's existing utility continues to deliver power, maintain the grid, provide consolidated billing and other customer services.	Owned, operated, and maintained by a nonprofit, special purpose entity, or utility	No	CCAs are currently legal in CA, NJ, IL, MA, OH, RI, NY and under consideration in MN, DE, and UT.	Typically try to build in a portfolio of local generation. Could include school property.	Yes	No O&M required	Yes, typically at lower n standard rates
UTILITY-SUPPLIED								

Green tariffs/utility renewable tariffs	The utility develops or procures renewable energy resources specifically for the customer and charges the customer under a special tariff (which may be higher or lower than the normal price of power).	The utility or utility subcontractor owns, operates, and maintains the infrastructure.	No. Note that school districts are typically a major customer and may be able to push the utility to pursue more ambitious renewable energy investment plans.		Utility-provided/ centralized	Case-by-case basis	No O&M required	The school district is arged under a special iff (may be higher or ver than normal price o wer).
REC-only based green power programs	The utility offers premium "green power" rates to customers, who purchase the environmental benefits of renewable energy credits. (RECs) via their utility bill.	The utility or utility subcontractor owns, operates, and maintains the infrastructure.	No		Utility-provided/ centralized	Case-by-case basis	No O&M required	[no guarantee unless gotiated?]