THIRD EDITION | SEPTEMBER 2020

Brighter Future

A STUDY ON SOLAR IN U.S. SCHOOLS

PUBLISHED BY Generation180

IN PARTNERSHIP WITH SEIA Solar Energy Industries Association® The SOLAR FOUNDATION™ for a bright future

ABOUT US

Generation180 inspires and equips individuals to take action on clean energy.

We envision a 180-degree shift in our energy sources – from fossil fuels to clean energy – driven by a 180-degree shift in people's perception of their role in making it happen – from apathy to agency, from despondency to determination, from hopelessness to hopefulness. Join us.

SOLAR FOR ALL SCHOOLS CAMPAIGN

Generation180 is working toward a future in which all of our schools are completely powered by clean energy.

We are leading a solar schools movement nationwide that will reduce energy costs, enhance student learning and foster healthier communities for all. The Solar for All Schools campaign leverages the integral role K-12 schools can play in reaching students, parents, neighbors and local decision-makers to encourage clean energy action throughout the community.

Inspiring a Brighter Future

Generation180 is sharing success stories and best practices from schools and districts around the country that have flipped the switch to clean energy. Through our reports, blogs, videos, presentations and digital content, we are helping schools understand the benefits of going solar.

Mapping the Solar Schools Movement

We are tracking the fast-growing number of schools nationwide that tap into the power of the sun. Our interactive online map helps you identify solar schools near you and learn more about their systems, including the installer, system size and funding mechanism. Explore the map at SolarforAllSchools.org to find out how your state ranks in the adoption of solar in schools.

Building a Toolbox for Going Solar

- The How-To Guide for Schools Going Solar offers step-by-step advice for going solar and includes an introduction to solar finance.
- The Solar Schools Campaign Toolkit is an organizing guide for students, parents, teachers and community members who want to catalyze solar energy at their schools.
- The Virtual Help Desk provides a library of resources, answers frequently asked questions and offers personalized support.

Empowering and Connecting Educational Leaders

Generation180 is building a network of school leaders to share their knowledge and experience with peers. We are co-hosting the National Solar Tour to showcase school solar projects and provide a platform for leaders to share about the benefits of solar.

LEARN MORE
Generation180.org
SolarforAllSchools.org

CONTACT US
solarschools@generation180.org

We recognize the vision and leadership of our partners at The Solar Foundation (TSF) and Solar Energy Industries Association (SEIA), who initiated this study over five years ago.

In September 2014, The Solar Foundation and Solar Energy Industries Association released the first comprehensive study and census on solar at nationwide K-12 schools, "Brighter Future: A Study on Solar in U.S. Schools." Generation180 partnered with these two organizations on the second edition of the report released in November 2017. This third edition of the Brighter Future report is the result of continued partnership and collaboration with these industry leaders. We thank Shawn Rumery at SEIA for his leadership and guidance on the data collection and analysis. We thank Ed Gilliland at TSF for his expertise and contributions to the research and writing.

ABOUT SEIA®

The Solar Energy Industries Association® (SEIA) is leading the transformation to a clean energy economy, creating the framework for solar to achieve 20% of U.S. electricity generation by 2030. SEIA works with its 1,000 member companies and other strategic partners to fight for policies that create jobs in every community and shape fair market rules that promote competition and the growth of reliable, low-cost solar power. Founded in 1974, SEIA is a national trade association building a comprehensive vision for the Solar+ Decade through research, education and advocacy. Visit SEIA.org.

ABOUT THE SOLAR FOUNDATION

The Solar Foundation® is an independent 501(c)(3) nonprofit organization whose mission is to accelerate adoption of the world's most abundant and solar-compatible technologies that are integrated into all aspects of our lives. The Solar Foundation's wide-ranging initiatives include solar jobs research, workforce diversity and clean energy market transformation. Through the SolSmart program, The Solar Foundation has engaged with local partners in more than 370 communities nationwide to advance solar energy growth. Learn more at TheSolarFoundation.org.

ACKNOWLEDGMENTS

MOUNTAIN VIEW SCHOOL DISTRICT, CA | CREDIT: PFMG SOLAR

We want to recognize the following organizations for their contributions to the data collection for the census: Ameresco, Clean Energy Resource Teams (CERT), Illinois Clean Energy Foundation (ICEF), New York Power Authority (NYPA), North Carolina Green Power (NCGP) and the Wisconsin K-12 Energy Education Program (KEEP).

We would like to thank the many people who shared their inspirational stories with us: Michael Hester, Batesville School District; Rick Vance and Adam Ness, Entegrity; Hans Meyer, Ameresco Renewable Energy Group; Christine Johnson, NYC Department of Education Sustainability Office; Karen Alsen and Sarah Pidgeon, Solar One; Laura Capps, Santa Barbara Unified School District School Board; Craig Lewis, Clean Coalition; Felix Gonzalez, Josefina Leon Zayas High School, Puerto Rico; Ana Sophia Mifsud and Roy Torbert, Rocky Mountain Institute; Glen Kizer, Foundation for Environmental Education; Gabriela Martin, Illinois Clean Energy Community Foundation; Mahider Tadesse, East High School; Andie Madsen, West High School; Lisa Hoyos, Sierra Club, Climate Parents; Sammy Firkins, Gwen Newport, Annie Son and Kathy Hall, Jason Lee Middle School; Siri Pierce, SolaRISE Portland.

Finally, this report would not have been written without the Real Energy Writers team, including Elisa Wood, Lisa Cohn and Yasmin Ali.

Thanks to the entire Generation180 team, including staff, senior fellows and interns, for its hard work and dedication to this project.

COVER PHOTO: TUSTIN UNIFIED SCHOOL DISTRICT, CA | CREDIT: PFMG SOLAR

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PUBLISHED SEPTEMBER 2020 BY GENERATION180

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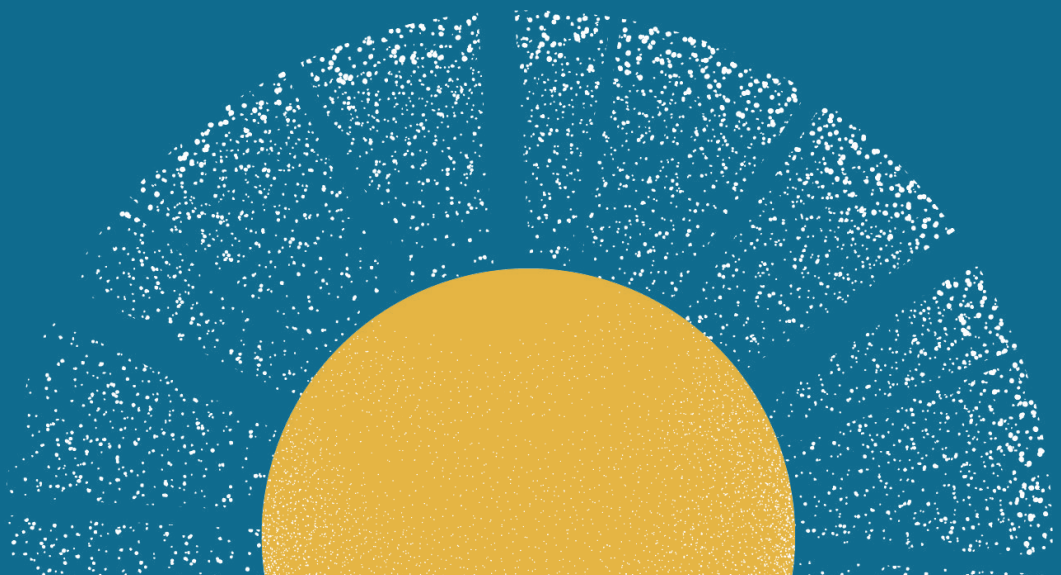
P.S. 62 THE KATHLEEN GRIMM SCHOOL FOR LEADERSHIP AND SUSTAINABILITY, STATEN ISLAND, NY | CREDIT: JAMES EWING/OTTO

Schools are more than brick-and-mortar buildings, more than the meeting places for classroom instruction. They are centers of lifelong learning, societal guideposts and beacons for opportunity.

In this third edition of “Brighter Future: A Study on Solar in U.S. Schools,” we showcase how schools are leading the way to a clean energy future in their classrooms, on their campuses and throughout their communities.



Introduction

Today's schools are called upon to achieve greater efficiencies, enrich the learning experience and manage it all during a pandemic and economic downturn. This report brings to light how going solar brings more to the educational landscape than just a new source of electricity. In fact, it can directly help schools with many challenges.

School leaders and students from California to Puerto Rico have shared their stories about how going solar:

- Reduces energy costs and frees up capital to invest in curriculum and teachers
- Provides students with authentic hands-on learningand job training opportunities
- Anchors a school as a community resource for safety and comfort during disasters
- Achieves carbon reduction and serves as inspiration for others to do the same

FARMINGTON HIGH SCHOOL, FARMINGTON, UT
CREDIT: PAUL RIVERA, VCBO ARCHITECTURE

Considering these benefits, it's not surprising that by the end of 2019, 7,332 U.S. schools had installed solar, nearly double the number of five years earlier. Even more impressive, schools are installing greater solar capacity, with solar production up 81% over five years ago. More than 5 million students now attend schools with solar, a 24% increase since 2017 and an 81% rise since 2014.

Solar is attracting a diverse set of educational institutions. Some are wealthy, others struggling; some urban, others deeply rural. They are in Western states, Eastern states or somewhere in between. So why do some states, such as California, New Jersey and Massachusetts, become "Head of the Class" for solar? Which are the eight states that "Need Tutoring"? How are schools paying for the transition to solar? See our rankings, review the analysis in the Key Findings, and read the success stories to explore these questions.

SNAIL LAKE KINDERGARTEN CENTER, SHOREVIEW, MN | CREDIT: IPS SOLAR

More than **5 million** students now attend schools with solar.

This report analyzes the growth of schools going solar and shares insights into how and why they are doing it. The success stories of trailblazing schools and districts offer inspiration and lessons learned in order to help other schools move forward with greater confidence and success, including:

- An Arkansas school district that is using savings from its solar project to give teachers pay raises.
- A New York City school program that uses school solar installations to make energy awareness part of classroom learning from Kindergarten up. The on-site solar also creates opportunity for older students — 853 so far — to participate in technical training for jobs in the fast-growing solar installation field.
- A solar microgrid at a school in the remote mountains of Puerto Rico designed to provide energy to ensure the community is fed when the town gets cut off from others because of mudslides, hurricanes and earthquakes.

This report also analyzes emerging trends that create new opportunities for schools to go solar, and it provides useful resources for school decision-makers and solar champions to do so. We welcome you to read on and start your school on the journey to a brighter future through solar.

Key Findings

Solar schools are now generating enough energy to power 254,030 U.S. homes.

Nationwide Growth of Solar at Schools

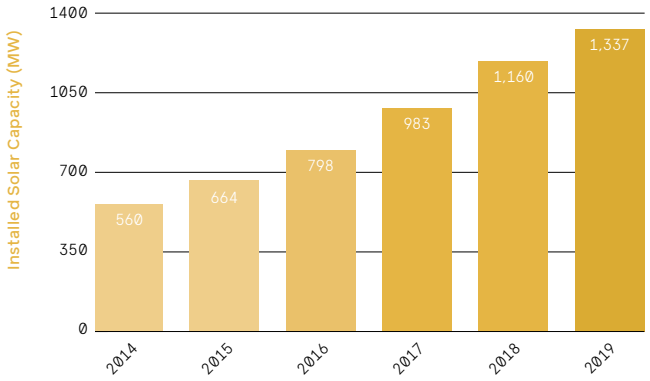
Eager to reap the many benefits of going solar — from energy savings to hands-on educational opportunities — installed solar on schools has increased 139% at U.S. schools since 2014, when the first edition of this report was published. SEE FIGURE 1.

Nationwide, the number of schools with solar grew by 81%, up from 4,061 schools in 2014. (SEE FIGURE 2). Today, 5.3 million students[1] attend 7,332 solar schools in this country, nearly doubling the number of students with access to solar since the first edition of this report. Solar schools now make up 5.5% of all public and private K-12 schools,[2] almost doubling from 3% of U.S. schools in 2014.[3] The decision to go solar at public schools is typically made at the district level, and 16% of K-12 school districts (2,231 in total) have embraced this technology.

With 1,365 MW of cumulative installed capacity, solar schools are now generating enough energy to power 254,030 U.S. homes.[4] For the past five years, schools have accounted for 8%-10% of the cumulative installed solar capacity of nonresidential projects, which includes government, nonprofit and commercial customers.[5] The rate of growth for schools aligns with the rise of solar in the nonresidential sector.

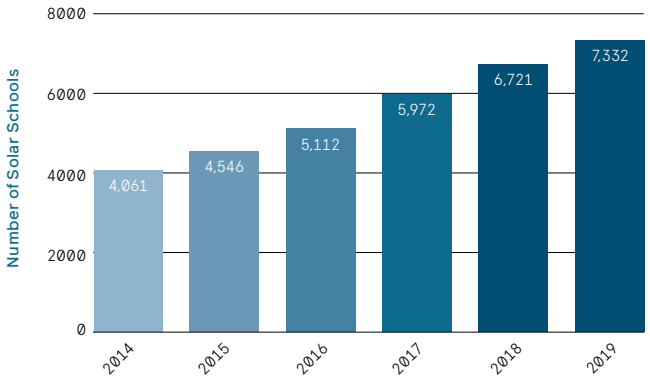
139% 5-YEAR GROWTH in Cumulative Installed Solar Capacity

FIGURE 1
Growth in Installed Solar Capacity at Schools



81% 5-YEAR GROWTH in Number of Schools

FIGURE 2
Growth in Number of Solar Schools



National Statistics for Solar Schools

CUMULATIVE THROUGH 2019

7,332 NUMBER OF SOLAR SCHOOLS

5.5% PERCENTAGE OF ALL K-12 SCHOOLS WITH SOLAR

1,337 MW INSTALLED SOLAR CAPACITY

5,346,186 NUMBER OF STUDENTS ATTENDING A SOLAR SCHOOL

2,231 NUMBER OF SCHOOL DISTRICTS WITH SOLAR

182 kW AVERAGE SYSTEM SIZE PER SCHOOL

9.4% PERCENTAGE OF STUDENTS ATTENDING A SOLAR SCHOOL

16% PERCENTAGE OF ALL K-12 SCHOOL DISTRICTS WITH SOLAR

HEAD OF THE CLASS

TOP TEN STATES FOR SOLAR SCHOOLS

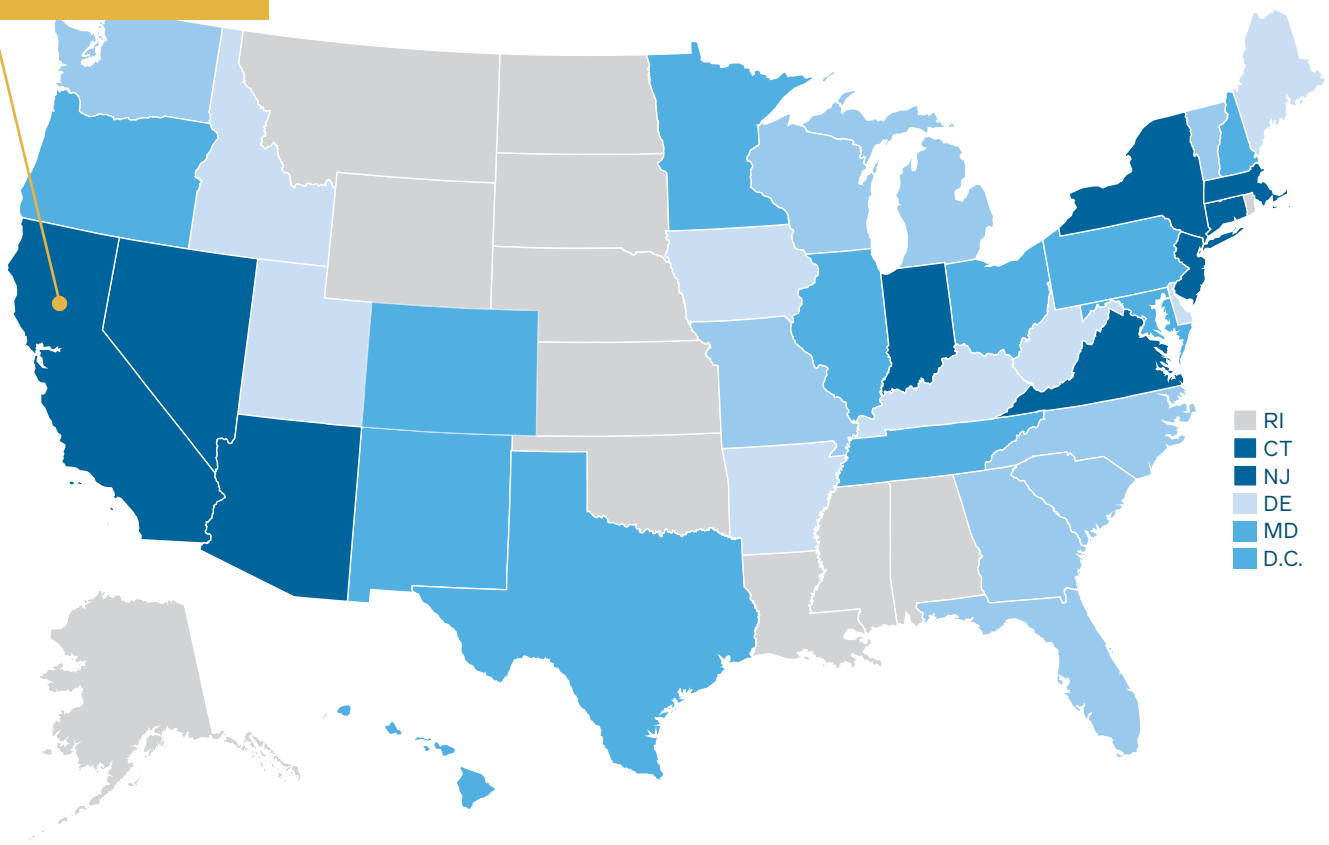
RANK	INSTALLED SOLAR CAPACITY (kW)		NUMBER OF SCHOOLS WITH SOLAR		NUMBER OF STUDENTS ATTENDING A SOLAR SCHOOL	
01	CA	616,058	CA	2,430	CA	2,033,413
02	NJ	181,944	NJ	621	NJ	407,751
03	AZ	125,187	IL	455	FL	302,699
04	MA	71,148	AZ	400	IL	271,990
05	IN	41,076	MA	292	AZ	270,233
06	NY	35,907	FL	280	MA	192,706
07	CT	32,171	NY	260	NY	185,476
08	VA	20,214	CT	205	MD	132,957
09	NV	20,159	MD	184	CT	126,414
10	IL	19,997	NV	176	TX	116,191

CUMULATIVE THROUGH 2019

State Report Card for Solar Schools

VALEDICTORIAN

California is home to one-third of the nation's solar schools and 45% of the installed capacity



TOTAL SOLAR CAPACITY IN K-12 SCHOOLS BY STATE:

0–0.5 MW	0.5–1.99 MW	2–4.99 MW	5–19.99 MW	>20 MW

MOST IMPROVED

Three fastest growing states for installed capacity*

- Indiana
- Virginia
- Illinois

*Moved up from Bottom Half in 2014 to Top 10 in 2019

DEAN'S LIST

Top 3 states for % of schools with solar

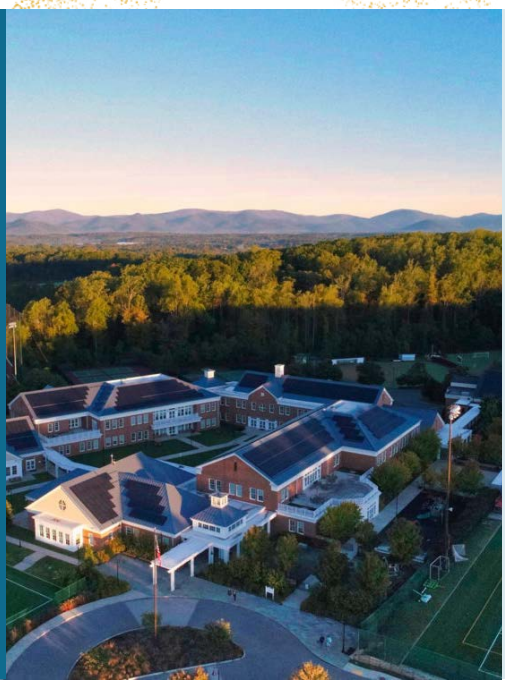
- Hawaii 29%
- District of Columbia 23%
- Nevada 20%

NEEDS TUTORING

Bottom 8 states with 5 or less solar schools

- Nebraska
- Wyoming
- Alaska
- Alabama
- Mississippi
- North Dakota
- Oklahoma
- South Dakota*

*The only state with ZERO solar schools



ST. ANNE'S BELFIELD SCHOOL, CHARLOTTESVILLE, VA
CREDIT: SKYCLAD AERIAL, SUN TRIBE SOLAR

SPOTLIGHT ON VIRGINIA

For the first time, Virginia made it to the Top Ten list for installed solar capacity, jumping to ninth for MW capacity, up 12 spots from its previous ranking.

Since 2017, the number of solar schools in Virginia has tripled and the installed solar capacity has increased tenfold. What drove the proliferation of solar? School districts in Virginia gained the ability to go solar through third-party power purchase agreements, which remove upfront and maintenance costs and provide immediate electricity bill savings. Arlington Public Schools and Middlesex County Public Schools both expect to save more than $4 million in energy costs over the next 25 years.

New legislation passed in 2019 will continue to expand opportunities for Virginia schools to go solar. Fairfax County Public Schools, the 10th largest district in the country, is developing a solar project that includes over 100 school sites and will save taxpayers $60 million over 25 years.[8]

READ MORE in Generation180's report, Powering a Brighter Future in VA (January 2020).

VISIT SolarForAllSchools.org to download it.

Impact of State and Utility Policies

GO TO
Appendix B on page 45 to see the complete State Rankings for Solar Schools

States with high penetrations of solar in the nonresidential sector[6] — including commercial, industrial, government and nonprofit — also have high numbers of solar schools. Not surprisingly, these rates are linked to favorable government and utility solar policies and incentives and third-party financing options.

California and New Jersey have remained the top two states in both number of solar schools and cumulative installed solar capacity since 2014. New York and Massachusetts have consistently ranked among the top states for solar schools. All of these states share clean energy mandates, solar incentives and access to third-party financing options. They also have high electricity prices, which means greater electric bill savings and a shorter payback period for system owners.

In contrast, states that consistently rank at the bottom for solar schools face utility barriers, poor net metering policies and few options for financing. Alabama and Mississippi do not allow third-party ownership. Oklahoma, Nebraska, Wyoming, North Dakota and South Dakota have some of the lowest electricity rates in the country, which minimizes the financial rewards of going solar. South Dakota is ranked last as the only state with zero solar schools. These states have consistently stayed at the bottom of the solar schools rankings since the first edition of this report.[7]

Prevalence of Third-Party Financing Without Upfront Capital Costs

While many school districts may mistakenly believe they must squeeze dollars from their already constrained budgets or capital improvement plans to go solar, that is not actually how most school districts fund their solar projects. School districts are catching on to the fact that third-party ownership makes it possible for schools to finance solar projects without having to make an upfront capital investment or spend on ongoing maintenance costs. According to available data on school methods of financing, third-party ownership is how 79% of the solar installed on schools is financed.

GO TO
Energy Cost Savings
on page 17 to learn more about different ways that districts finance their solar projects and save on energy costs

A power purchase agreement, or PPA, is the typical third-party arrangement in which a solar developer funds, owns and maintains the solar energy system for a set period, often ranging from 10 to 25 years. In a PPA, the school district pays for the energy produced by the solar system, usually at a lower rate than what the district paid the utility for electricity. With this type of funding, schools see immediate energy savings that typically increases over time as the utility's electricity rates rise.

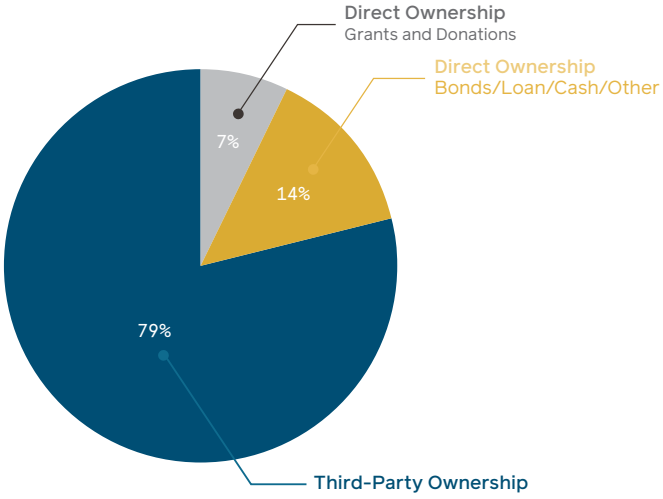
While third-party ownership is the predominant way schools finance their solar energy systems, it is currently allowed by law in only 28 states (and D.C.).[9] The states that allow third-party ownership account for 91% of the solar installed at schools nationwide. That means the remaining 22 states only account for 9% of the solar installed on schools. Lack of access to third-party financing is stifling solar development in almost half the country. The schools in those states without access to this financing mechanism must find funds in their budget, seek out donations and grants, raise the money to go solar, or issue bonds.

79%

of the solar installed at schools was funded and owned by a third party, typically with no upfront cost to the schools.

FIGURE 3

CUMULATIVE SOLAR CAPACITY INSTALLED ON K-12 SCHOOLS BY FINANCING TYPE

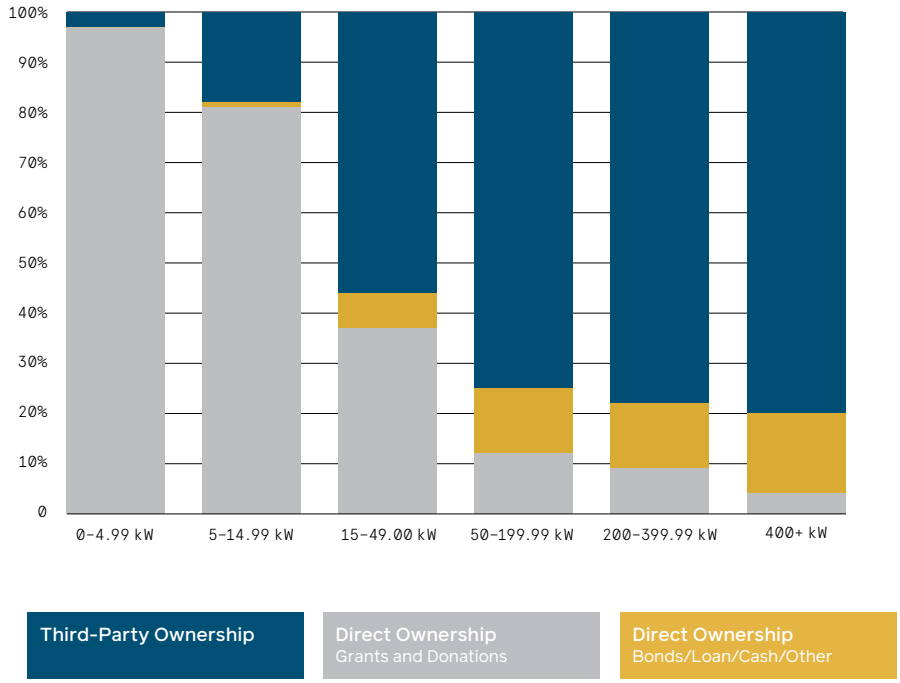


Size Matters

While small demonstration systems are mostly funded by grants and donations, third-party ownership is the main way schools fund systems over 15 kW.

FIGURE 4

SCHOOL SYSTEM SIZE DISTRIBUTION BY FINANCING TYPE



GO TO
Electrifying Learning
on page 25 to find a list of organizations and utilities that currently provide grants to schools for educational solar systems

TO LEARN MORE
about solar financing, download the How-To Guide for Schools Going Solar at SolarForAllSchools.org

Minority of Systems Owned and Funded by Schools

Only 21% of the solar installed on schools is purchased, owned and maintained by the schools, also known as direct ownership. SEE FIGURE 3. That breaks down to 14% paid for by the schools with cash, loans or bonds and 7% gifted to schools through grants and donations.

Grants and donations are the primary sources of funding for small demonstration and educational projects. Eighty-eight percent of the solar projects under 15 kW were paid for with grants and donations. For solar energy systems over 15 kW, third-party ownership becomes the primary funding mechanism and its utilization increases with the size of the solar energy system. For systems over 50 kW in size, direct ownership through cash, loans and bonds is the second highest source of funding. SEE FIGURE 4.

Why Schools Are Going Solar

The number of schools installing solar nearly doubled over the past five years, and for good reason. Flipping the switch to solar can cut a school's energy costs, reduce power outages, open the door to new classroom exploration of clean energy in all subjects, and provide job training in a fast-growing industry.

Energy Cost Savings

At $8 billion a year, energy is the second largest expense for U.S. schools.[10] By switching to solar, schools can reduce and stabilize energy costs and reinvest the savings into other school priorities.

READ ABOUT a school district in Batesville, Arkansas, that paid for teachers' raises through solar energy savings on page 17.

Electrifying Learning

Located on-site, a solar installation offers hands-on, real-world learning opportunities valuable in the study of science, technology, engineering and math.

READ ABOUT how teachers at hundreds of schools across Illinois are integrating solar energy into the classroom on page 25.

Job Training

By installing solar, schools support local employment and create vocational training opportunities. Solar installer is one of the country's fastest growing occupations.[11] During the last five years, solar employment increased 44%, five times faster than job growth in the overall U.S. economy.[12]

READ ABOUT how New York City high school students gain solar job training and even install solar on their own schools on page 22.

Energy Resilience

Solar with battery storage and microgrids provide backup power during grid outages, preventing classroom disruptions. Schools with these technologies easily convert into emergency community shelters during natural disasters.

READ ABOUT the Santa Barbara Unified School District's plan to install microgrids that ensure energy reliability and require no capital investment by the district on page 28.

Students Leading the Charge

Students are speaking up and taking action, urging their schools to lead the transition to clean energy and make meaningful climate commitments. And when they do, schools inspire the community, encouraging staff, students and their families to make clean energy choices at home.

READ ABOUT high school students in Portland, Maine, who are leading the charge for their school district to go solar on page 32.

Healthy People and Planet

Switching to solar reduces fossil fuel pollution and protects the health of people and the planet. If all the K-12 schools in the U.S. were completely powered by the sun, it would eliminate carbon dioxide pollution equivalent to shutting down 18 coal-fired power plants.[13] Cleaner air would reduce the 13 million school absences in the U.S. per year caused by childhood asthma.[14]

Energy Cost Savings

As schools grapple with how to manage the next school year amidst budget shortfalls brought on by the pandemic, educational leaders are hungry for solutions that reduce costs for schools without sacrificing quality of education.

Because personnel is their largest expenditure, school districts are being forced to freeze hiring and furlough or lay off teachers and staff. Energy costs are the second highest expense for school districts,[15] making going solar an effective strategy to shrink costs and increase financial resilience.

Here are just a few inspiring stories from school districts around the country that are harnessing the power of the sun to fund initiatives for their school communities.

- A pioneering school district in Arkansas is using its energy savings from solar energy and energy conservation to **fill gaps in the budget, increase teacher salaries and retain quality staff.**
- The third largest district in Arizona will be **saving $43 million over 20 years** from 73,000 solar panels.

TO LEARN MORE

about different options to fund your solar project, download the How-To Guide for Schools Going Solar at SolarForAllSchools.org

SUCCESS STORY IN BATESVILLE, ARKANSAS

Energy Savings Reap Investments in Teacher Pay and Education

BATESVILLE SCHOOL DISTRICT
ARKANSAS

District Size
3,281 students at **7** schools

Installed Capacity
759 kW at Batesville High School and Jr. High School

Structure
Ground-mounted tracking panels and solar canopy

Energy Offset
Approximately **50%** of district's energy use

Cost Savings
$2.4 million in gross solar savings over 20 years. Savings guaranteed with an energy savings performance contract (ESPC)

Financing
Bond for **$5.4 million** to purchase solar energy system and efficiency upgrades

Developer
Entegrity

In 2017, Dr. Michael Hester became the superintendent of the Batesville School District. At the time, the district was underfunded by $250,000. His district paid the lowest teacher salaries out of the five districts in Independence County, Arkansas, and he was losing great teachers because of the low pay. He knew he couldn't serve his students well unless he could retain their best educators.

After an initial energy audit showed that the district was paying over $600,000 annually in utilities, he sought to cut energy and water costs to eliminate the budget deficit instead of shuttering schools or laying off teachers. The district partnered with energy services company Entegrity to install 759 kW of solar on two campuses along with upgrades in lighting, energy efficiency and water efficiency. Through an energy service performance contract (ESPC), Entegrity guarantees that the energy and operational savings will pay for the project costs each year and generate additional savings.

Currently the largest solar installation in any school district in Arkansas, Batesville's 1,483 solar panels generate about half of the district's electricity needs and provide a savings of nearly $100,000 per year.

The teachers were also asked to contribute to the savings by conserving energy in the buildings. In exchange, they'd get pay raises. Hester told his staff, "We have to go into footprint reduction and efficiency mode. If you do this with us, we will get you the money back with raises that will attract and retain staff."

BATESVILLE SCHOOL DISTRICT, AR | CREDIT: ENTEGRITY

BATESVILLE SCHOOL DISTRICT, AR | CREDIT: ENTEGRITY

The district has reduced its energy consumption by 1.6 million kWh per year and expects a net savings of over $4 million over 20 years from the solar energy generation, energy conservation and water efficiency upgrades. A portion of the energy savings is going back to the teachers as pay raises averaging $2,000 to $3,000 per year and up to $9,000 per year for some long-time employees.

Thanks to this project and other strategic cost reductions, the district went from a $250,000 budget deficit to a $1.8 million surplus within three years. Now the district ranks first in teacher pay out of the five districts in the county. According to Dr. Hester, “Putting money into staff is the best way to put students first.”

A portion of the energy savings is going back to the teachers as pay raises averaging $2,000 to $3,000 per year and up to $9,000 per year for some long-time employees.

According to the superintendent, the most surprising part about the project was the positive response from the community, which is situated in the backyard of the largest coal-fired power plant in the state. Community members drive up to the school to see the long solar canopy that frames the front of the high school now. They are happy to see that the school district has been a good steward of their tax dollars.

The neighboring school districts have also taken notice. Entegrity reports that there are 20 school districts surrounding Batesville that are interested in going solar and achieving the same savings and added benefits.

Staying true to the spirit of his district’s mascot, the Pioneers, Superintendent Hester is continuing to explore new frontiers with clean energy. He already is planning his next solar project and aims to be the first net zero energy school district in the state.

Thanks to newly passed legislation that expanded the solar energy system size allowed per customer and enabled third-party ownership, Batesville School District plans to sign a solar service agreement with Entegrity to add 757 kW of solar at an offsite location with no upfront or ongoing maintenance costs.

“Our goal is to be net zero on utilities, which would mean paying nothing for utilities. Those savings can go to salaries and staff,” said Hester.

SUCCESS STORY IN TUCSON, ARIZONA

Saving $43 Million Over 20 Years

TUCSON UNIFIED SCHOOL DISTRICT
ARIZONA

District Size
47,200 students at **89** schools

3rd largest in Arizona

Installed Capacity
23.8 MW at **80** schools

Largest K-12 solar producer in Arizona

Structure
73,000 photovoltaic panels on shade canopies in parking lots and school yards

Energy Offset
47% of district's annual energy use

Cost Savings
$43 million over **20 years**

Financing
20-year third-party solar services agreement with Constellation

More than 47,000 students enjoy an up-close view of renewable energy at work at Tucson Unified School District (TUSD). The largest of its kind among K-12 school districts in Arizona, the project delivers solar energy to 80 schools and reduces carbon dioxide emissions by 38.7 million pounds per year. The district has been recognized as the top green power user among K-12 schools in the U.S. Environmental Protection Agency (EPA) Green Power Partnership, and it received the Governor's Award for Energy & Technology Innovation.

TUSD paid nothing upfront for the system, and it projects energy cost savings of up to $43 million over 20 years. The three-phase project was financed through third-party power purchase agreements (also known as solar services agreements) with Constellation. The district will purchase the clean energy produced by the solar panels for 20 years at a fixed rate below what the utility charges.

CREDIT: TUCSON UNIFIED SCHOOL DISTRICT

CREDIT: TUCSON UNIFIED SCHOOL DISTRICT

> "Solar energy at TUSD is helping a whole generation of young people understand how to be conscious energy users."
>
> **JONATHAN ROTHSCHILD**
> MAYOR OF TUCSON

At TUSD, solar demonstrates for the school community the value of clean energy, at work and at play. The teachers use online monitoring data to create hands-on learning opportunities, and the students enjoy the much-needed shade provided by the solar canopies installed in the play areas.

Since the completion of the project, the district has deepened its commitment to reduce utility costs and increase energy, water, and waste efficiency. An Energy Performance Innovation Committee has been established that will help the district develop and implement short-term and long-term sustainability goals and prepare guidelines for all employees and students to reduce districtwide consumption of energy, water, and waste

"Solar energy at TUSD is helping a whole generation of young people understand how to be conscious energy users," said Mayor Jonathan Rothschild.

Electrifying Learning and Job Training

Schools are tasked with preparing young people for the future. By bringing solar technology to schools, students can gain real-world science and engineering skills, train for one of the fastest-growing occupations in the country (solar PV installer), and get equipped a future that will be increasingly reliant on clean energy.

Schools are leveraging solar technology as hands-on learning labs, and teachers in every grade can use the solar panels and energy system data for project-based, interdisciplinary, and authentic lessons. Many school districts are now integrating energy-themed curricula and offering professional development to show teachers how to bring energy and climate change into their classrooms. In Illinois, one community foundation is helping offer solar panels and teacher trainings to schools across the state.

With the clean energy sector growing rapidly, schools with solar are also able to expand career and technical education in high schools and better prepare students for the jobs that will be available when they graduate. The New York City Department of Education is training students on solar PV installation and offering internships for students to install solar on NYC DOE schools, spreading the benefits of solar to even more students across the city.

With over 5 million students now attending a school with solar, the future is already getting brighter.

SUCCESS STORY IN NEW YORK CITY

Preparing a Clean Energy Generation

New York City aims to be carbon neutral by 2050. As part of this ambitious plan, buildings operated by the City of New York will house 100 MW of solar by 2025 — that's enough clean electricity to power about 15,000 homes annually. With nearly 1,400 facilities spread across the five boroughs, the New York City Department of Education (NYC DOE) public schools will host the largest share of these solar installations.

NYC DOE, the largest school system in the nation, promptly recognized the unique opportunity presented by the city's solar commitment to help prepare its 1.1 million students for a future powered by clean energy. With more than 250 solar installations either completed or underway at public schools, NYC DOE and its partners leveraged these projects to provide STEM learning and vocational training opportunities to students.

In 2016, the NYC DOE Office of Sustainability partnered with Solar One, a nonprofit energy and sustainability education organization, to design and deliver the NYC Solar Schools Education Program. Through this program, Solar One trains NYC DOE teachers on how to deliver self-guided, inquiry-based learning that builds STEM, engineering and problem-solving skills in alignment with established standards.

Over 1,000 K-12 teachers have participated in the program to-date and have been given lessons on solar energy, energy efficiency and energy storage; kits with motors, lights, multimeters and solar panels for class activities; a toolbox of activities broken down for different age groups; and continuing education credits to help maintain professional certifications.

NEW YORK CITY DEPARTMENT OF EDUCATION

District Size
1,126,501 students at **1,866** schools

Largest district in U.S.

System Size
9 MW on **44** schools

Over 200 more solar projects underway

Municipal goal of **100 MW** on city-owned buildings by 2025

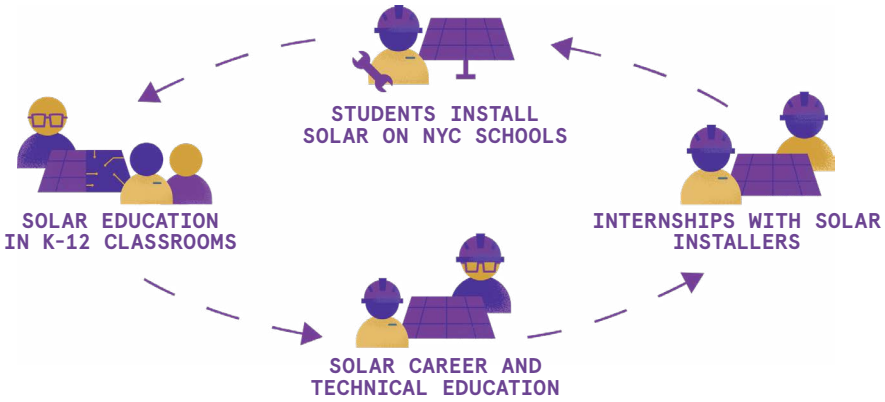
Financing
Mix of third-party ownership and direct ownership through capital budget and grants

SOLAR SCHOOL PROGRAM INTERNS, NEW YORK, NY
CREDIT: NYC DOE SUSTAINABILITY

SPOTLIGHT ON NYC SOLAR SCHOOLS EDUCATION PROGRAM

- More than **2,500** students participated in solar schools program
- **43,124** students attend a school with solar
- Over **1,000** teachers trained on solar curriculum
- **853** students trained in Solar Career and Technical Education program
- Students can intern with solar developers to install solar on NYC schools

NYC SOLAR SCHOOLS EDUCATION PROGRAM GOES FULL CIRCLE



Teachers also learn how to use solar energy production data in classroom lessons focused on data analysis and weather patterns. These lessons and all of the NYC Solar Schools Education Program activities provide a critical platform for learning about climate change and renewable energy that tie to many topics in the existing curriculum. As one teacher explained, "Our school is moving our curricula towards project-based learning, and this is perfect for incorporating interdisciplinary learning and activities around topics like sustainability, renewable resources and climate change."

The program also features technical training for students at NYC DOE Career and Technical Education (CTE) high schools. Students at 13 CTE high schools receive hands-on, skill building training in solar installation and attend a Solar Career Expo where they engage directly with solar industry professionals. The Expo gives students a sense of the diversity of roles available in the industry and an opportunity to make job connections. To-date, almost 1,000 CTE students have received technical solar training and exposure to career opportunities in this high demand field.

Coming full circle with the program, the NYC DOE and Solar One organize student internships with solar companies that are installing solar on public schools. For these students, the school system where they learned about solar also becomes the place they work on their first solar installations as paid interns. Students garner the educational and financial benefits of the program while having an opportunity to bring solar energy to more NYC schools.

As Lucia, a student at Queens Technical High School in NYC, put it, "Solar jobs are the future. There are so many problems with the environment and global warming that will affect our future. We need to make the earth better."

The NYC DOE Office of Sustainability and its partners have heard the call to action voiced by students and believe that connecting clean energy investments to classroom learning will inform and empower the next generation of environmental stewards.

"Solar jobs are the future. There are so many problems with the environment and global warming that will affect our future. We need to make the earth better."

LUCIA
STUDENT AT QUEENS TECHNICAL HIGH SCHOOL

SUCCESS STORY IN ILLINOIS

A "Solarbration" Across the State

SOLAR SCHOOLS IN ILLINOIS

455 solar schools in Illinois, **3rd** highest in country

96% are **1 kW** educational systems funded by the Illinois Clean Energy Community Foundation

271,990 students in Illinois attend a school with solar

Ninety-six percent of the solar schools in Illinois have received grant funding from the Illinois Clean Energy Community Foundation to install 1 kW solar systems on site. This statewide effort to spread solar education has propelled Illinois into third place for number of schools with solar installations in the U.S., trailing behind only California and New Jersey. Through this program, the foundation has made solar energy accessible to hundreds of communities and more than 250,000 students.

The goal of the program is to educate young people who will make better energy choices in the future. These compact solar systems are designed to be educational tools to teach students about clean energy. Therefore, each school that receives a grant from the foundation must make the solar panels visible to the students, commit to utilizing the system to teach about solar, and hold a public "Solarbration" that is open for the surrounding community to attend. Each school receives free teacher training provided by the National Energy Education Development (NEED) project on how to integrate solar into the classroom. The foundation also assists schools with site assessments, vendor selection, installation and system maintenance over the years. This support gives school leaders familiarity with the solar development process, if they decide to move forward with a larger power-generating solar energy system.

WASHINGTON MIDDLE SCHOOL, JOHNSON CITY, IL. | CREDIT: ILLINOIS CLEAN ENERGY COMMUNITY FOUNDATION

GRANTS FOR SOLAR SCHOOLS

Nearly 90% of solar energy systems (under 15 kW) have been funded by grants or donations. There are a handful of grant opportunities currently available for schools to get started with a small solar array:

ILLINOIS CLEAN ENERGY COMMUNITY FOUNDATION

The K-12 Solar Schools program offers grants to support the installation of 1 kW photovoltaic (PV) systems throughout Illinois. Grantees receive assistance to coordinate system installation as well as curricular support.

NC GREENPOWER

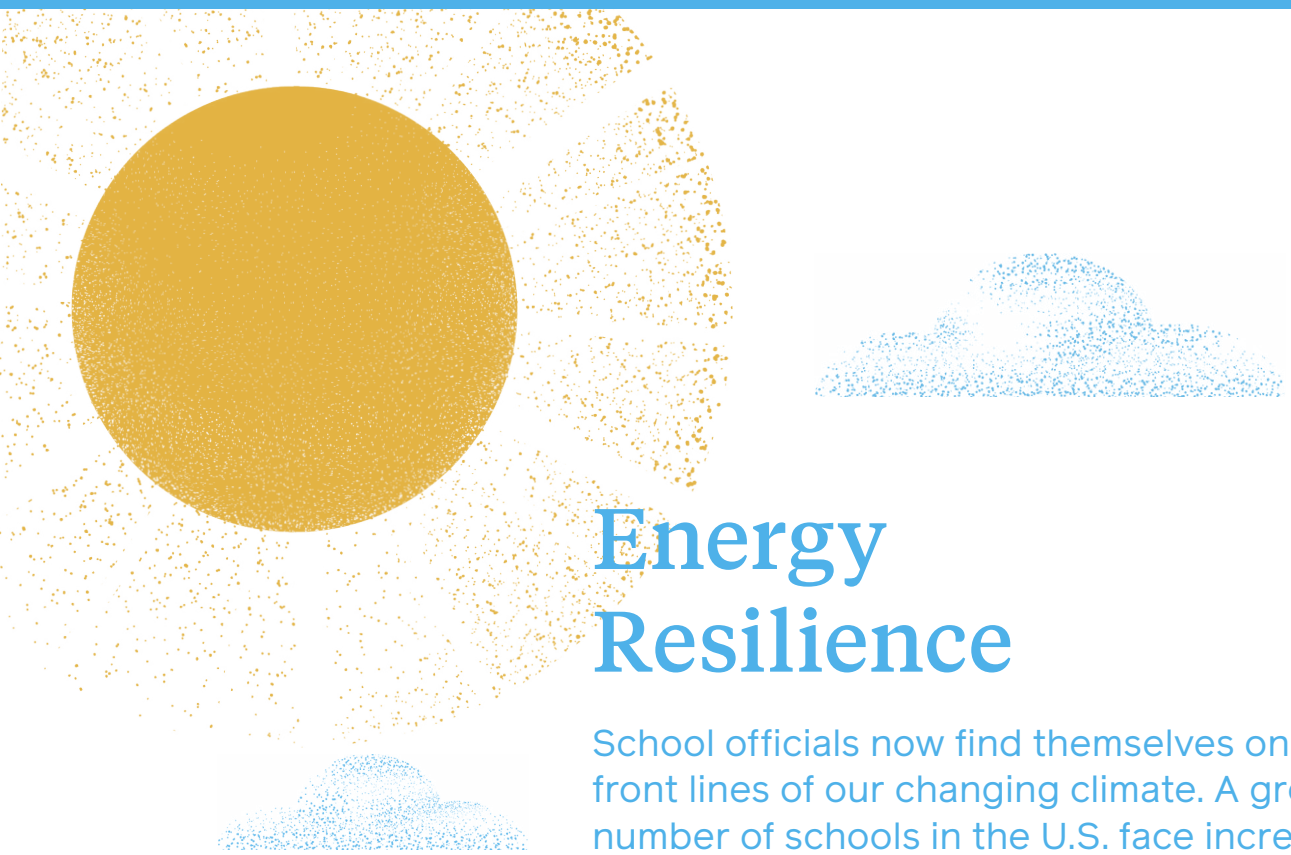
The Solar+Schools grants provide 3-5 kW solar educational projects at schools, complete with a weather station, data monitoring, curriculum from NEED.org and training for teachers. Any North Carolina K-12 school may apply.

WISCONSIN COUILLARD SOLAR FOUNDATION

In partnership with the Midwest Renewable Energy Association, Solar on Schools aims to subsidize solar installations on Wisconsin's public schools. For solar systems <100 kW, a school will be granted up to 50% of the panels required for the solar project. For systems 100 kW+, a school will be granted 50 kW of panels.

DOMINION SOLAR FOR STUDENTS

Dominion Energy's Solar for Students program provides participating public schools a 1.2 kW solar system, educational materials and training for educators.



Energy Resilience

School officials now find themselves on the front lines of our changing climate. A growing number of schools in the U.S. face increased power outages and escalating natural disasters, including wildfires, hurricanes and massive flooding.

Schools with resilient energy take on a new level of importance in their communities. They can serve as safe havens in times of crisis, electrified shelters where community members can gather, charge cell phones, contact loved ones and perhaps get a hot meal.

Energy resilience is broadly defined as the ability to recover from a power outage quickly or avoid it altogether. A solar photovoltaic system alone does not provide back-up power to a school during a grid outage. For technical and safety reasons, the panels cease to operate until the grid is restored. But schools can achieve energy resilience by coupling their solar panels with energy storage, typically batteries, and by forming their energy systems into nanogrids or microgrids.

Nanogrids and microgrids offer some big advantages by powering critical loads when there is a power outage. In California, microgrids are being used to keep schools operating during rolling blackouts. In Puerto Rico, solar microgrids are ensuring that school refrigerators stay cold and that the food needed to feed students stays fresh. When there is a power outage, classrooms remain lit and comfortable, computers keep running and school meals are served. In short, the school continues its mission without interruption. Then, when conditions return to normal, and backup power

Funding Energy Resilience

Schools do not need to pay for an energy resilience system upfront or devote staffing to operate these sometimes complex systems to gain these benefits.

With an as-a-service contract, similar to a PPA, a third-party operator manages operations. Newer software-driven microgrids undertake many functions autonomously that third-party operators monitor remotely.

TO LEARN MORE
about solar financing, download the How-To Guide for Schools Going Solar at SolarForAllSchools.org

TECHNOLOGIES FOR RESILIENCE

MICROGRID

A self-sufficient system fueled by one or more energy sources that serves a single facility or a discrete geographic footprint, such as a school campus.

Microgrids offer two major services:

- Provide backup power for longer periods than solar plus storage systems alone, by using microgrid controls to disconnect or "island" from the grid during a power outage and serve their host independently.
- During normal conditions, the microgrid remains connected to the grid and can take services from the grid or supply services to the grid.

SOLAR PLUS STORAGE

A battery system that is charged by a connected solar system.

The battery can provide backup power when solar panels do not produce energy, such as evenings or cloudy days, or when the grid goes down. Unlike microgrids, solar plus storage by itself cannot island from the grid.

SMART STORAGE SYSTEMS, CALIFORNIA | CREDIT: SHARP

is no longer needed, resilient energy technologies act as 24/7 resources that can be programmed to help schools earn money in energy markets and cut electricity costs. For example, the system may use its battery for cost savings by discharging during peak hours or times when electricity rates are higher.

School districts around the country are beginning to turn to solar-powered microgrids to provide resilience for their students and surrounding communities. In snowstorm-prone Frisco, Colorado, the Summit School District has proposed a microgrid, which will allow its middle school to be designated as an emergency shelter. The school's location makes it a convenient stop for stranded motorists when nearby I-70 closes during storms. The microgrid will be built in partnership with the local utility, Xcel Energy, as part of a $23.4 million utility-funded pilot program, which includes six other microgrids.

In Bainbridge, Indiana, the North Putnam Community School Corporation added 300 kW of battery storage to complement an existing 1.6 MW solar farm, which allows the high school to act as a community shelter during disasters. Commissioned in 2016, the project has created a positive cash flow to the district by both reducing electricity bills and selling energy back to the grid. The management software automatically determines when the electricity generated by the solar farm should be used by the building, sold back to the grid or stored in the batteries. The project saved $241,895 in the first year alone and will save the district $8 million over 20 years.[16]

SUCCESS STORY IN SANTA BARBARA, CALIFORNIA

Anchoring Schools as Heart of the Community with Energy Resilience

SANTA BARBARA UNIFIED SCHOOL DISTRICT
CALIFORNIA

District Size
14,355 students at **21** schools

Installed Capacity and Structure
Proposed **4.5 MW** of solar PV shade canopies at **14** school sites, **6** of the sites will have solar microgrids (total of **6 MWh** of battery storage)

Energy Offset
Projected **94%** of district's energy use

Cost Savings
No upfront capital costs and immediate electric bill savings once installed

Financing
RFP released in consultation with Sage Renewables for an expected **25-year** power purchase agreement

A school with resilient energy takes on a new level of importance in society. It can serve as a safe haven in times of crisis, an electrified shelter where community members can gather, charge cell phones, contact loved ones and perhaps get a hot meal.

"Even if you don't have kids, you know where your neighborhood school is. Schools are the heart of a community, and this solidifies their place," said Laura Capps, president of the school board for the Santa Barbara Unified School District, which is in the process of installing multiple solar-powered microgrids.

Capps began exploring sustainable solutions for the Santa Barbara district after being elected to the school board four years ago. She found the local schools behind in this pursuit since not one of the school buildings had solar when she came on board. This lack of solar schools wasn't born out of ideological opposition, but because officials were concerned about priorities. "There was the feeling that if you focus on sustainability you are taking your eye off the ball of literacy — the more fundamental mission of a school system."

But as she began researching other nearby school districts, she found they were actually saving money on their electricity by going solar, an opportunity created by California's high utility rates, solar incentives, and its widespread use of solar power purchase agreements. Capps discovered that one neighboring community had cut energy costs by almost $1 million annually by adding solar to its schools.

Capps' initial proposals for solar were integrated into a comprehensive energy resilience plan after Santa Barbara County was devastated by wildfires and subsequent mudslides in January 2018. The district found itself playing an important role in the community during that natural disaster, and it began to plan how it could keep operating school buildings during future power outages. The district's focus on energy resilience was sharpened in 2019 while millions of Californians lost power as utilities de-energized power lines to prevent them from sparking wildfires. The state's largest utility, Pacific Gas & Electric (PG&E), has warned that it may be forced to take such action repeatedly over the next decade when wildfires threaten.

Teaming up with non-profit consultant Clean Coalition, the Santa Barbara Unified School District is planning to deploy a sophisticated system that uses cutting-edge microgrid management strategies to create resilience while lowering costs. The design calls for solar+storage microgrids at six sites, and

A school with resilient energy takes on a new level of importance in their communities.

solar power alone at eight additional sites, which include three high schools, four junior high schools, five elementary schools, a district office, and a warehouse. The project is expected to include about 4.5 MW of solar capacity and 3 MW/6 MWh of battery energy storage that will be financed with a 25-year power purchase agreement (PPA) with no upfront capital cost for the district. (The school district had received competitive proposals from developers for the project as of this writing.)

The proposed system will incorporate a new, more precise way of calculating the monetary value of energy resilience, allowing the district to prioritize what appliances receive backup power and better quantify the investment. Loss of lights, for example, may cost the district little money, but loss of freezers quite a bit. The project also will manage the capacity of the battery in new ways to increase its ability to provide backup energy, while also leveraging its ability to earn revenue in energy markets.

Craig Lewis, executive director of Clean Coalition, believes Santa Barbara's system will become a standard that other schools will want to follow. "I think it's going to be a game changer for the industry in terms of general understanding of how solar microgrids need to be configured in order to provide the type of resilience that we need them to provide," Lewis said.

SIX SOLAR MICROGRIDS SITES AT SBUSD

SOLAR MICROGRIDS PLANNED FOR SIX SBUSD SITES | CREDIT: CLEAN COALITION

SUCCESS STORY IN PUERTO RICO

A Microgrid for Food Security

PUERTO RICO DEPARTMENT OF EDUCATION

District Size
Over **300,000** students at **847** schools

Project Size
Solar microgrids on **10** schools serving **3,600** students and **400** faculty members

Project Partners
Rocky Mountain Institute (RMI), Save the Children, and Kinesis Foundation

Funding
Fully funded by grants and individual donations

Solar Microgrid Benefits
Indefinite back-up power for school libraries, administrative offices, kitchens, and critical water pumps

For Josefina Leon Zayas High School in the remote mountains of Puerto Rico, losing power brings worry beyond interrupted learning time. In times of disaster, the school feeds the community.

Located in Jayuya, a town of 16,000 people that is prone to mudslides that deter travel, the high school can make up to 5,000 community meals. Storing that much food used to make the school's principal, Felix Gonzalez, uneasy. After all, during Hurricane Maria the school lost power for three months, and food spoiled.

But now, thanks to a microgrid (46 kW solar array with 36 kWh of battery energy storage) the food remains refrigerated even if the central grid fails. Food security is an issue not only for the community, but also for some of the students, who receive their only "real food for the whole day" at the school, Gonzalez said.

On top of that, the microgrid is saving the school about $20,000 per year in energy costs, a 50% reduction. "We can use the money in other ways to be more effective in our classes," Gonzalez said.

ÁNGEL RAFAEL "PAPO" DÍAZ COLÓN PRIMARY SCHOOL - OROCOVIS, PUERTO RICO
CREDIT: ROCKY MOUNTAIN INSTITUTE

ÁNGEL RAFAEL "PAPO" DÍAZ COLÓN PRIMARY SCHOOL - OROCOVIS, PUERTO RICO
CREDIT: ROCKY MOUNTAIN INSTITUTE

The microgrid is saving the school about $20,000 per year in energy costs, a 50% reduction.

The school paid nothing for the microgrid; instead it was funded by donations and grants, part of the humanitarian effort following the devastation of Hurricane Maria. Because of the storm, Puerto Rico's children have collectively missed out on more than 13 million full days of learning. The public education system shut down for two months as the island endured the largest power outage in U.S. history. Some schools remained without power long after, and many could not reopen for a full school day if refrigeration was not available to store food for student lunches. It took a year to fully restore the island's electricity.

The experience left many questioning the practicality of relying solely on the island's power grid in an age of climate disasters. A central grid is vulnerable to cascading failures because of its interconnected structure.

Out of this concern grew a pilot program launched by the Rocky Mountain Institute, Save the Children and the Kinesis Foundation to create school microgrids. So far, the program has built solar microgrids in 10 schools, including in Jayuya, serving 3,600 students in all. The organizations have plans for more.

Students Leading the Charge

Successful school solar projects often begin with a champion. In many cases, it is someone from the staff or administration. Increasingly, it is students who are leading the way, and school districts are embracing their interest to catalyze solar initiatives.

Climate change has galvanized student activists from coast-to-coast who are raising their voices and speaking up for the future they want to see. Students from Tacoma, Washington to Portland, Maine are playing a powerful role in persuading their school districts to go solar. School districts can learn from these examples and support emerging student leaders who are honing a range of valuable skills, from organizing campaigns to exercising civic rights and communicating through media.

> "Right now, combating the climate crisis is what is most important for our futures."
>
> **SIRI PIERCE**
> STUDENT AT CASCO BAY HIGH SCHOOL

STUDENT SOLAR ACTIVISTS - PORTLAND, ME | CREDIT: SOLARISE PORTLAND

SUCCESS STORY IN PORTLAND, MAINE

Students Spark the Largest Solar School Project in State

PORTLAND PUBLIC SCHOOLS
MAINE

District size
6,750 students at **19** schools

System Size and Structure
3,500 kW offsite ground array

Energy Offset
60%-80% of district's energy use

Cost Savings
Projected **$50,000** per year

Financing
Power purchase agreement

For students in Portland Public Schools, persistence and coalition building pay off — in real dollars. Following a two-year student campaign, the school board in August 2019 approved a 3,500 kW offsite solar project that will provide 60% to 80% of the district's energy and save an estimated $50,000 in energy costs per year.

The story began in 2017 when students and staff at King Middle School proposed a solar installation at the school that required $65,000 in funding. It didn't go well. The city questioned the costs and did not prioritize the project. However, the students didn't quit. Instead, they made their effort bigger, combining the district's three high schools into an organization called SolaRISE Portland. They marched in the streets, set up a Facebook page and raised money online. Soon they had $25,000 from local businesses and other donors. They used some of this money to hire CES Inc. to facilitate the RFP process. The city and school district collaborated to broaden the scope of the project. Now the city will offset two-thirds of its energy burden with solar.

"School systems work for children, for us. You teach us and empower us so we're ready to face whatever comes our way," said Siri Pierce, a student at Casco Bay High School. "And right now, combating the climate crisis is what is most important for our futures."

Superintendent Xavier Botana stated at a school board meeting: "We talk about the value and importance of student voice all the time, and this is a perfect example of why it matters. These students are on their way to making significant and lasting change in this community and, I do not think it is hyperbolic to say, in the world."[17]

STUDENT LEADERS MARCHING FOR SOLAR - PORTLAND, ME | CREDIT: SOLARISE PORTLAND

SUCCESS STORY IN TACOMA, WASHINGTON

The Power of Student Voices

TACOMA PUBLIC SCHOOLS
WASHINGTON

District Size
~30,000 students at **60** schools

System Size
Planning for **100 kW** at Jason Lee Middle School

Cost Savings
Projected up to **$14,000** per year

Financing
Raised over **$120,000** in grants to purchase and own the **$225,000** system

You might say that students Gwendolyn Newport, Sammy Firkins and Annie Son began at the top. They had a plan to make their middle school the first with solar in Tacoma Public Schools, the third largest district in the state of Washington. They brought their idea to the governor.

The "Watts Up!" project was kickstarted when these middle school students were selected to be speakers at the governor's STEM Education Innovation Alliance meeting in February 2019 at the state capitol. They shared their idea with Governor Jay Inslee, a champion of climate change initiatives, and presented their project to the statewide, multistakeholder STEM Alliance members.

"We were so nervous, we kind of blanked out when we presented," said Newport, age 14. But when the students finished their presentation, audience members began texting the Tacoma Public Schools administrators, urging them to support the move, said Kathy Hall, the 7th grade science teacher who mentored the students on the project. For the students, it was an empowering moment. "After we presented, so many people came up to us and offered their support and business cards," said Son, age 15.

TO LEARN MORE

download Generation180's Solar Schools Campaign Toolkit, a step-by-step guide with resources to start a solar campaign at your school, at SolarforAllSchools.org

STUDENT ACTIVISTS AT JASON LEE MIDDLE SCHOOL, TACOMA, WA
CREDIT: DREW PERINE, THE NEWS TRIBUNE

> "I fully believe it was the voices of these young ladies that made us get to where we are right now."

KATHY HALL
TACOMA PUBLIC SCHOOL
SCIENCE TEACHER

The students later brought their request to the school board. Thanks to their advocacy, a 100 kW solar array is planned for Jason Lee Middle School and the school board is now looking into opportunities to install more solar districtwide. "I fully believe it was the voices of these young ladies that made us get to where we are right now," said Hall. "If I had gone up there as a teacher, they would have said, 'Yeah, right.' "

With the help of their teacher, the students have raised over $120,000 in grants from Tacoma Public Utilities, Bonneville Environmental Foundation and the Pierce Conservation District. Even though the students have since moved on to high school, they are continuing to fundraise for their middle school and meet their goal of $225,000 to buy the solar array.

LEARN MORE about and donate money to the Watts Up! project at JasonLeePTATacoma.org/wattsup/.

REACH OUT TO
Sierra Club's Climate Parents program
for support and resources to lead a 100% Clean Energy School District campaign.

Sierraclub.org/Climate-Parents

VISIT
Schools for Climate Action
to find resources for students and parents who want their school districts to speak up on climate change. Find a list of school districts nationwide who have passed school board resolutions with climate commitments.

SchoolsForClimateAction.weebly.com

STUDENTS CALL FOR 100% CLEAN ENERGY

> "I never thought our involvement would reach this level of impact. This campaign has shown me what a big difference a group of high schoolers can make in leading the way for climate action."

MAHIDER TADESSE
A STUDENT IN SALT LAKE CITY, UT

Salt Lake City, Utah

In Salt Lake City, Utah, the school board voted to transition to 100% clean energy based on a student campaign seeded in an advanced placement science class.

The effort was led by students from Salt Lake's three major high schools, in collaboration with Utah Sierra Club and Sierra Club's Climate Parents program. In addition to presenting at the school board, students collected over 800 signatures from students, parents and staff in support of the resolution.

Los Angeles, California

Tatiana Velasquez, an 11-year-old student from Gaspar de Portola Middle School was one of the students who urged the Los Angeles Unified School Board to support a resolution to address climate change.

Now the school district — the second largest in the country with over 600,000 students — has committed to 100% renewable energy by 2030.

New Horizons

Taking Solar Off-Campus

In recent years, schools have taken steps to capture the benefits of solar without actually installing solar panels on campus.

Following the lead of municipalities and businesses, they are now purchasing solar power that is produced off-site or partnering with municipalities, utilities or even private companies to procure clean energy both on-site and off-site. These green power purchases can take the form of community solar, utility green tariffs and off-site solar power purchase agreements (either supplied to the school facilities or to the grid).

ST.JOSEPH COMMUNITY SOLAR GARDEN, MN | CREDIT: IMPACT POWER SOLUTIONS

WHAT ARE RENEWABLE ENERGY CERTIFICATES (RECS)

A Renewable Energy Certificate (REC) equals 1 MWh of renewable energy. The owner of the REC has the right to claim they are using renewable energy. RECs are prevalent in states with a designated renewable portfolio standard (RPS) or renewable energy standard (RES), which requires utilities to source a certain amount of the energy they generate or sell from renewable sources. Solar Renewable Energy Credits (SRECs) are a type of REC created specifically by the generation of solar energy.[20] SRECs are created in markets that include a solar set-aside as part of the RPS.[21]

To meet set-aside mandates, utilities need to either develop solar energy or acquire SRECs from others such as households that install rooftop solar.

A school district that acquires green power through one of the methods discussed in this section would typically retain the SRECs or RECs, but in some cases ownership of RECs may need to be negotiated. Ownership of the RECs is required in order to claim the environmental attributes of the clean energy purchased and publicize the use of green power.

Unbundled RECs can be purchased to show investment in clean energy without going through more complex processes to secure clean power. These RECs are not tied to the physical delivery of electricity to the customer, but are instead purchased from a separate entity than the customer's electricity provider.

ST. JOSEPH COMMUNITY SOLAR GARDEN, MN | CREDIT: IMPACT POWER SOLUTIONS

COMMUNITY SOLAR

Community solar, or shared solar, enables customers who lack available land or rooftops to access solar. A solar developer or utility can serve as host and then sell shares of the solar electricity to multiple customers in various locations. In addition to creating access to clean energy for renters and those who can't purchase their own system, community solar increases access for schools that have aging rooftops, shaded buildings or other constraints that make going solar a challenge.

Community solar typically requires state policies that support a third party to sponsor development. Absent such legislation, only utilities can sponsor community solar. As of 2019, virtual net metering or other favorable community solar policies had been enacted in 19 states plus D.C. To date, 43 states have at least one completed community solar project.[18]

Community solar is experiencing rapid growth nationally. Annual installation has grown from 33 MW in 2015 to 540 MW in 2019. Minnesota leads with over a third of the nation's cumulative installed community solar capacity.[19] Programs in Minnesota have over 19,000 subscribers, serving both residential and nonresidential customers.

Over 25 school districts in Minnesota are participating in community solar projects as both hosts that earn revenue for leasing the land and as customers who purchase the electricity produced. Annandale Schools, East Carver County Schools, Triton Public Schools, Pine Island Schools and Waconia Public Schools are a handful of the districts in the state powering their schools with solar energy by joining an off-campus community solar garden.

GREEN TARIFFS

In some states, entities can work directly with utilities to source green energy. Utilities may have an electricity rate tied to specified renewable energy sources, such as solar. A city, company or school district can arrange to acquire the energy, often at a premium to the standard market electricity rate. The purchaser not only buys the electricity but also acquires the associated renewable energy certificates.

In Wisconsin, utility company Madison Gas & Electric (MGE) offers the Renewable Energy Rider program, whereby customers receive up to 100% of their energy from an off-site renewable energy project (paid for by MGE or a third party). MGE then bills the customer for the energy according to one of MGE's standard energy tariffs.

The Middleton-Cross Plains Area School District is participating in the Renewable Energy Rider program and will be purchasing energy produced at a 5 MW solar project being built by MGE. The school district will see significant savings.

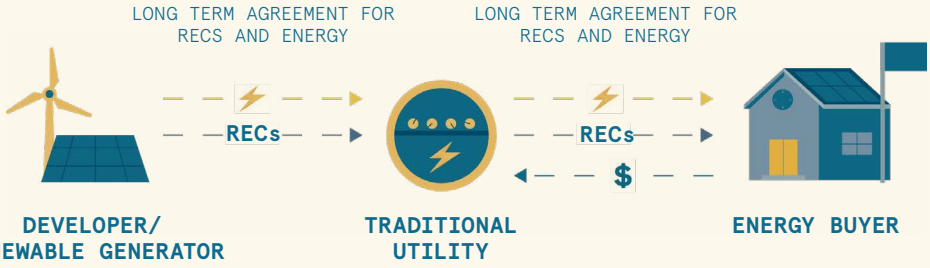
"We are excited about the potential in millions of dollars in energy savings over the next 30 years,"[22] said Dana Monogue, Middleton-Cross Plains Area School District superintendent.

UTILITY GREEN TARIFF

Utility contracts with renewable energy generator for power and RECs.

Customer may have input into renewable energy source

Customer pays alternative contracted rate for power and RECs



SOURCE: AMERICAN CITIES CLIMATE CHALLENGE

COMMUNITY CHOICE AGGREGATION
PARTNERING WITH LOCALITIES TO PROVIDE CLEAN POWER

Some cities and counties have decided to take control of the power that is delivered to their constituents through community choice aggregation (CCA).

In this model, local governments procure electricity on behalf of their residents and businesses, often with a goal of increasing the amount of clean energy generated. Cities and counties contract for the electricity while continuing to partner with the local utility to provide consolidated billing, transmission and distribution of the electricity.

Through the bulk purchase of energy, local jurisdictions can procure green electricity at prices that are comparable with, or lower than, utility rates. CCA programs can only be set up in states with enabling legislation. As of 2019, eight states (California, Illinois, Massachusetts, New Jersey, New York, Ohio, Rhode Island and Virginia) had enacted CCA legislation.[23]

Depending on the state's law, a CCA may be able to automatically enroll utility customers, including schools, in the program. Those who do not want to participate can opt out.

The city of Lancaster, California provides one example of how a municipality partnered with its two regional school districts to develop solar and subsequently integrate the power into the city's CCA. Through the Lancaster Power Authority, the city entered into a PPA with the district to finance, install, own and operate 7.5 MW of solar on 25 district sites. The system was funded through a tax-exempt municipal bond in partnership with tax equity investors, resulting in a 20% savings in school district energy costs.[24] When the city later created its CCA, it integrated the district solar system into its overall green power portfolio, enabling it to offset some of the costs of its other power purchases.[25]

RED WING COMMUNITY SOLAR GARDEN, MN | CREDIT: IPS SOLAR

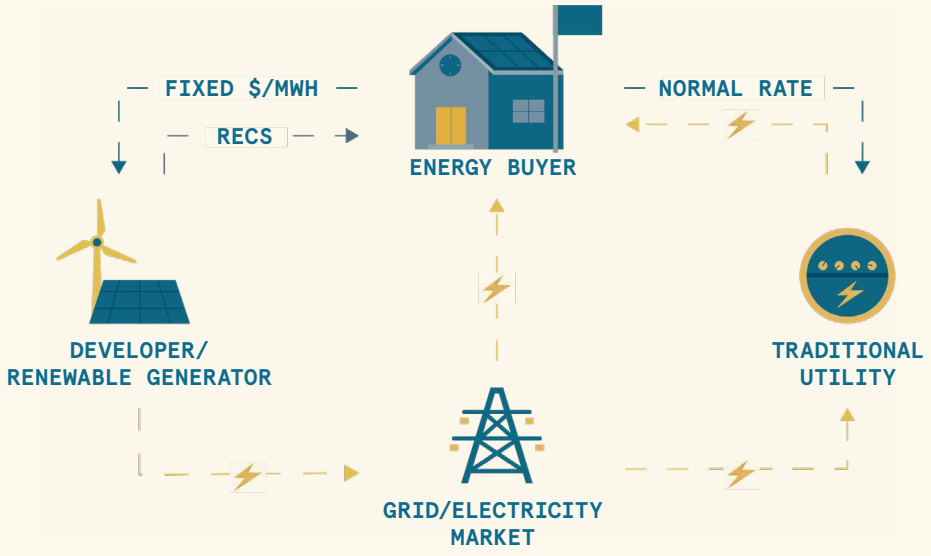
OFF-SITE PHYSICAL PPA

1 The energy buyer signs a PPA with a project developer for a fixed price per MWh. This allows the project to be financed and built.

2 The developer delivers the electricity from the generator to a "delivery point" close to the buyer's operations. The buyer takes physical delivery of the energy and the RECs.

3 The buyer purchases a lower volume of electricity from their utility in the usual manner.

4 The utility provides grid mix electricity without RECs.



SOURCE: AMERICAN CITIES CLIMATE CHALLENGE

OFF-SITE SOLAR PPA

While school districts have been using on-site physical PPAs to fund solar energy projects, the use of off-site solar PPAs is a relatively new frontier for them. For off-site solar supplied to facilities, the customer enters into a contract with a solar developer to deliver electricity near the customer's location. The energy buyer takes possession of the power, paying the price negotiated in a PPA. This approach opens the way for lower cost solar because the projects can be built in rural areas with open fields where land is relatively cheap. The solar development can be large, achieving economies of scale that reduce development costs on a per MW basis. These vehicles are generally allowed only in states that allow retail choice, meaning consumers can choose their electricity supplier. About 90% of renewable energy purchased by cities and counties is procured through off-site physical PPAs.[26]

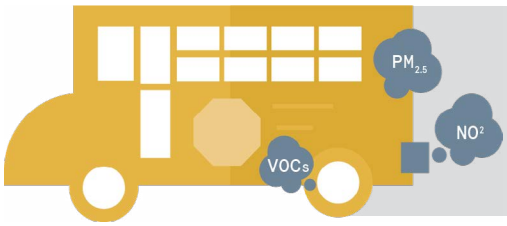
For off-site power supplied to the grid, the energy buyer contracts with a solar developer to supply or partially supply its power from an off-site solar array. The power is sold into the wholesale energy market with the proceeds going to the energy buyer, who, in turn, pays the developer based on the predetermined PPA price. This is typically arranged as a virtual PPA, which is an agreement under which the buyer never takes ownership of the energy (as opposed to a physical PPA) but instead simply receives the revenues generated by selling the electricity into a wholesale market.[27] Such an arrangement is possible in states and regions that are part of a centrally organized wholesale electricity market. In such regions, multiple power generators compete to provide power.

Electric School Buses

Solar energy is a good investment for schools to reduce energy costs over time and contribute to a cleaner, healthier environment for all. Another important trend is emerging that can enhance the investment: school bus electrification.

The deployment of electric school buses has increased rapidly since 2014 when the first all-electric school bus was delivered to the Twin Rivers Unified School District in Sacramento, California. Five years later, the U.S. had more than 400 electric school buses in operation, and the numbers are projected to rise.

Like solar energy, electric school buses eliminate emissions that are harmful for both public health and the environment. And, also like solar, electric school buses cut operational costs. For example, the Twin Rivers Unified School District, which operates a fleet of 30 electric school buses, reports savings of $15,000 per bus every year. For a school running on solar energy, operating electric school buses could be even more cost-effective, especially if any excess solar energy can be stored and reused to charge the school buses as needed. This is not a distant dream. In 2010, plug-in hybrid school buses were deployed in conjunction with a solar-energy powered canopy at a school district in Wisconsin.[28] Since many schools already have solar canopies for their buses and more districts are deploying electric school buses, we can expect to see more frequent overlaps of solar energy and electric school buses.[29] [30]



DIESEL BUS
Diesel bus exhaust pollutes the air with lung-clogging emissions — a big problem for the 25 million children who ride these buses every day.

EV BUS
Clean, quiet electric buses eliminate hazardous pollution, keeping kids healthier

Electric school buses also open the doors to innovative resource management strategies. As the average school bus is parked 50% of the time, its battery becomes a powerful energy asset, allowing the next level of interaction between the vehicle and the surrounding infrastructure through "vehicle-to-grid" (V2G). Using bidirectional charging, V2G allows the dispatch of energy when and where needed. In addition, V2G can be used strategically to generate revenue at peak times when energy is more expensive and typically highly polluting. School districts in California and New York have been piloting V2G technology. In partnership with tech companies and utilities, they are working to reduce the total cost of ownership of electric school buses in two ways: by reselling electricity stored in batteries and by taking advantage of time-of-use rates to charge at off-peak times. Current V2G pilots suggest that a bus can generate $5,000 to $20,000 per year in electricity revenue.[31] Schools are expected to undertake more pilots in the coming years as additional manufacturers produce V2G-capable buses.

ELECTRIC SCHOOL BUS | CREDIT: TWIN RIVERS UNIFIED SCHOOL DISTRICT

CONCLUSION

Today there are thousands of solar schools. This report tells the story of only a handful of the trailblazers demonstrating the clean energy future that is possible for all schools. Thousands more can reap the benefits — from substantial budget savings to elevating student voices, to reducing emissions and fostering community resilience.

When we started tracking solar on schools in 2014, we found early adopters laying a foundation upon which other schools could build. Now, in 2020, many early challenges have been overcome. Solar technologies have evolved, and districts are beginning to pilot and explore solar microgrids. Costs to go solar have dropped and financing mechanisms have been proven. Students are speaking up about climate change and demanding clean energy at their schools. For the 94% of schools that haven't yet reaped the benefits of solar, now is the time.

If your school has not yet gone solar, Generation180 provides a myriad of resources and information for getting started at SolarForAllSchools.org. The updated How-To Guide offers step-by-step instructions for going solar and includes an introduction to solar financing. The Solar Schools Campaign Toolkit provides the guidance and resources to advocate for solar. The virtual Help Desk offers a collection of articles and resources to answer frequently asked questions.

If your school has already gone solar and has seen the benefits, there is still much more you can do to advance our clean energy future. We hope you keep advocating for more clean energy at your school, district and surrounding community. You can become an ambassador for solar schools by sharing your knowledge and connecting with nearby schools and districts to help them start the solar journey. You can support students and other community advocates in their efforts to bring about positive change. You can help advocate for better clean energy policies with your utility and in your state.

Generation180 wants your help to reach our vision to help all schools access the benefits of solar.

Join the movement! Please visit SolarForAllSchools.org to learn more.

APPENDIX A

Methodology

The methodology for collecting data for the national census of solar schools was developed by Solar Energy Industries Association (SEIA) and Generation180 for the third edition of the Brighter Future report and builds off the process used by SEIA for the previous two editions.

While we have made every effort to ensure this database is as complete as possible, it was not possible to reach all 135,000+ schools nationwide to verify their solar data.

We invite readers to contribute to this effort by providing any new solar schools data to Generation180 at SolarForAllSchools.org.

DATA COLLECTION

The national census of solar schools includes operational solar installations above 1 kW that were installed prior to the year 2020. The solar installation must be installed on the property of or be providing electricity to a U.S. public school, private school or educational center servicing students in grades pre-K through 12. When a school district installs a solar array whose energy is not assigned to specific buildings, all of the schools in the district are included in the census and are allocated an equal portion of the system size.

The census utilized a database from the National Center for Education Statistics' Elementary/Secondary Information System (ElSi) for a comprehensive list of U.S. public and private K-12 schools with corresponding geographic and demographic information. The ElSi tool used available data beginning in 1986-1987 to the most recent school year of the Common Core Data (CCD) and Private School Survey (PSS): 2017-2018.

Since the release of the last edition of this report in November 2017, Generation180 has been accepting and verifying solar schools data that it receives from the public through its website SolarForAllSchools.org. SEIA collects data on solar projects across all sectors on an ongoing basis, and it contributes any available data it has on schools toward the census.

The data for this report was primarily collected between September 2019 and February 2020 from a variety of sources and combined with the existing solar schools database. Data was cross-checked across sources and database editions to prevent double-counting and to verify new sources. Much of the information came from publicly available data provided by state incentive and net metering programs, including the New Jersey Clean Energy Program and the California Division of the State Architect. Data was also collected from utility and nonprofit solar programs for schools, school websites, solar installer websites, press releases and news articles. Schools and solar installers across the country were selectively contacted for data collection and verification, including a survey to SEIA member companies. The Acknowledgments page includes companies and organizations that supported this data collection process.

DATA REPORTING

Any statistics in this report that indicate the amount of solar installed or the number of solar schools in a given year has included all of the data collected to date. We have identified additional solar projects that were installed in previous years that were not included in the previous report editions. The first and second editions of this report were released in September 2014 and November, 2017 respectively, and the numbers reported at the time did not include projects installed in the last few months of those years. Therefore, the numbers reported in this third edition provide the most updated count of solar schools each year.

APPENDIX B: STATE RANKINGS FOR SOLAR SCHOOLS

CUMULATIVE THROUGH 2019

	INSTALLED SOLAR CAPACITY (kW)		NUMBER OF SCHOOLS WITH SOLAR		NUMBER OF STUDENTS ATTENDING A SOLAR SCHOOL	
RANK	STATE	TOTAL kW	STATE	TOTAL	STATE	TOTAL
01	CA	616,058	CA	2,430	CA	2,033,413
02	NJ	181,944	NJ	621	NJ	407,751
03	AZ	125,187	IL	455	FL	302,699
04	MA	71,148	AZ	400	IL	271,990
05	IN	41,076	MA	292	AZ	270,233
06	NY	35,907	FL	280	MA	192,706
07	CT	32,171	NY	260	NY	185,476
08	VA	20,214	CT	205	MD	132,957
09	NV	20,159	MD	184	CT	126,414
10	IL	19,997	NV	176	TX	116,191
11	MN	18,649	MN	157	NV	98,607
12	MD	16,963	WI	148	MN	93,971
13	PA	15,330	TX	123	HI	84,596
14	OH	14,069	CO	119	CO	83,738
15	HI	11,980	HI	117	WI	82,503
16	DC	10,280	WA	109	WA	80,226
17	CO	9,198	UT	109	UT	79,522
18	TX	7,204	MO	91	VA	64,373
19	NM	7,049	VA	89	IN	59,639
20	TN	6,642	IN	88	MO	55,795
21	OR	5,736	OR	75	OR	51,034
22	NH	5,255	DC	64	PA	50,103
23	WI	4,827	OH	63	NC	44,406
24	FL	4,650	TN	63	GA	43,314
25	VT	4,317	PA	60	TN	35,387
26	MI	3,617	MI	58	MI	35,382
27	WA	3,540	NC	57	OH	32,163
28	SC	2,783	NM	49	NM	30,344
29	MO	2,733	VT	44	SC	28,839
30	GA	2,659	GA	44	DC	28,106
31	NC	2,657	MT	44	MT	18,605
32	IA	1,863	SC	43	NH	16,699
33	AR	1,800	NH	38	RI	14,590
34	KY	1,785	ME	32	ID	14,584
35	DE	1,657	ID	28	VT	13,956
36	UT	1,649	RI	24	ME	13,497
37	ME	1,436	IA	15	WV	9,046
38	WV	853	KY	12	KS	8,109
39	ID	515	DE	12	KY	7,424
40	MT	486	WV	11	DE	6,758
41	LA	390	KS	11	LA	5,849
42	RI	364	LA	8	AR	4,933
43	KS	312	AR	7	IA	3,889
44	WY	230	NE	5	NE	2,923
45	MS	100	WY	4	WY	1,551
46	ND	80	AK	3	AL	631
47	NE	19	AL	2	OK	521
48	AL	18	MS	1	AK	427
49	AK	13	ND	1	ND	169
50	OK	2	OK	1	MS	147
51	SD	0	SD	0	SD	0

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