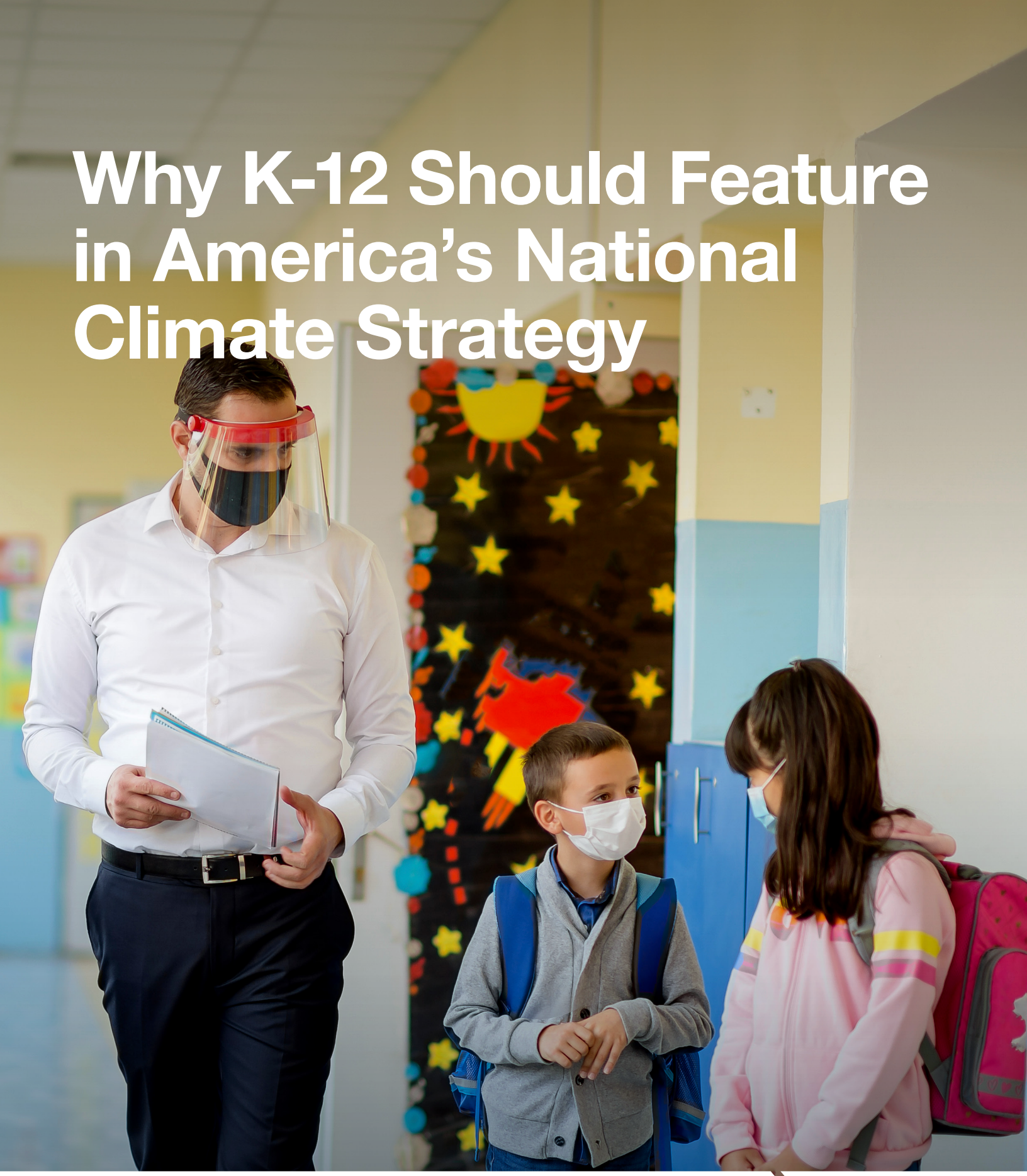
Why K-12 Should Feature in America's National Climate Strategy



nbi new buildings institute

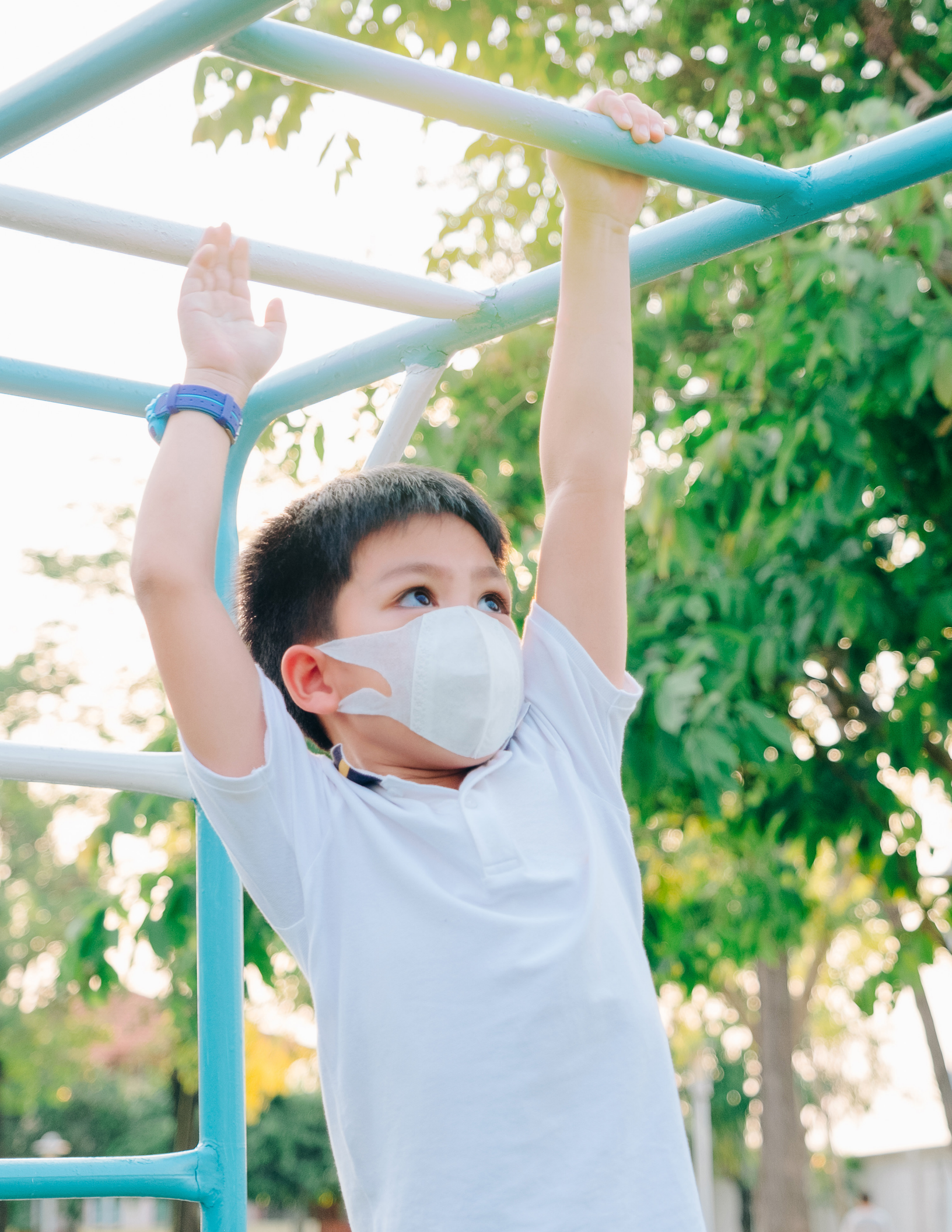
Coalition for Climate Education Policy

Advancing climate literacy for a just and sustainable future

UNDAUNTED K12

Climate-resilient schools and future-ready students

APRIL 2021



Turkey Foot Middle School rainwater catchment. | Edgewood, KY

Credit: Piaskowy and Cooper

Background

On his first day in office, President Biden recommitted the United States to the Paris Agreement, an international effort to address the climate emergency. In rejoining the Paris Agreement, the United States must define and commit to deliver greenhouse gas (GHG) emissions reductions. This commitment, otherwise known as a Nationally Determined Contribution will serve as our goal for the next five years of climate action and should translate into plans at all levels of government—federal, state, and local—and across all sectors.

The need for ambition has never been greater. In a 2020 report, the Intergovernmental Panel on Climate Change report calls on the global community to achieve a 45% reduction (against a 2010 baseline) in global net emissions by 2030 in order to avoid the most catastrophic impacts of global warming and irreversible damage to the planet.[1] The United Nations has warned that current commitments don't come close to achieving that target.[2]

At the sub-national level, 25 states have joined the **US Climate Alliance**, but most are not achieving emissions reductions in line with their targets. **An analysis** of the state-led effort suggests that current climate policies have been insufficient to achieve the needed emissions reductions.[3] Meanwhile, the **Net-Zero America** report points to zero-carbon buildings as one of five pathways for the United States to achieve drastic emission reductions and decarbonize its entire economy. Education has been identified as currently underutilized and a key **social tipping point** to achieve rapid decarbonization. As the United States charts a path to regain its leadership position on the global stage, deploying zero carbon strategies in education must be part of a people-centric, equity-focused agenda.

1 See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C. Available at: https://www.ipcc.ch/sr15/chapter/spm/.

2 Rowling, Megan (2021). "Climate pledges for 2030 put world far off 1.5C goal, U.N. warns" Reuters, February 26. Available at: https://www.reuters.com/article/us-climate-change-emissions-politics-trf/climate-pledges-for-2030-put-world-far-off-1-5c-goal-u-n-warns-idUSKBN2AQ1TZ.

3 Stilson, Drew (2020). "Turning Climate Commitments into Results: Progress on State-led Climate Action" Environmental Defense Fund, December. Available at: https://www.edf.org/sites/default/files/documents/FINAL_State%20Emission%20Gap%20Analysis.pdf.

What can the K-12 sector contribute to our national response to the climate crisis?

As the US looks to mount a strategic and credible plan to deliver on a Nationally Determined Contribution, policymakers cannot afford to overlook the uniquely transformational power of the K-12 sector. While our K-12 schools are responsible for a modest share of overall building[4] and transportation emissions in the US, the sector is positioned to catalyze increased awareness, public support, workforce development, innovation, and, most critically, the shifts in mindset that form the foundation for any success we might envision. Moreover, the K-12 sector is central to addressing equity and enhancing community resilience.

1 Job Creation in Communities across America

Modernization of K-12 schools has the potential to create millions of family-sustaining jobs across a range of skill levels and job types in every community in America. These jobs will be critical to cultivating the public and political support that will be needed to deliver on our NDC. There are current legislative efforts underway to make these jobs real. The Reopen and Rebuild America's Schools Act (S. 96/H.R. 604) will provide schools with $100 billion in targeted grants and $30 billion in bond capacity to repair existing K-12 buildings and will create an estimated 2 million jobs.[5]

2 Emissions Impact within Reach

As the second-largest form of public infrastructure after roads and highways, K-12 schools offer a sizable opportunity within the public sector to reduce greenhouse gas emissions. America's K-12 schools currently spend $8 billion on energy and produce emissions equivalent to 18 coal-fired power plants.[6] School buses represent the largest fleet of public transportation with about 480,000, largely diesel, buses in need of electrification.[7] As the US seeks to organize a coordinated effort at all levels of government, K-12 schools and school buses fall within a public span of control. This span of control is critical in responding swiftly to the climate emergency.

3 Visibility in Transformation and Benefits

With a school serving every community, America's public K-12 schools are highly visible and cherished components of our public infrastructure. The K-12 sector offers an opportunity to showcase in every community in America that building efficiency, building electrification, green and resilient school facilities and grounds, and electric bus deployment are both within reach and massively beneficial from economic, health, climate, and equity points of view. As public spaces, K-12 schools offer opportunities to collect and share data on the health and performance benefits of green buildings (e.g. data on absenteeism, cognitive function, teacher retention). Schools can play an important part in a "data strategy" to measure the human benefits of sustainability. Making climate change about people (not just "emissions") is key to garnering broad public support and engagement in the agenda.

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4 In their pre-announcement for their Healthy-Efficient Schools (HES) Initiative, the Department of Energy estimates that the electricity and natural gas consumption associated with public and private K-12 schools' building operations represent 0.8% of overall US greenhouse gas emissions.

5 See The Reopen and Rebuild America's Schools Act of 2021 Fact Sheet. Available at: https://drive.google.com/file/d/1vcLiU-c5AaP8Uzu8CbHV1xOatTrFQJRzn/view.

6 Sierra Club, 100% Clean Energy School District Organizing Toolkit, April 2019. Available at: https://drive.google.com/file/d/1z-8JPlamVfey-XiqO-MPY-zcIljjTxjUk/view?usp=sharing.

7 National School Transportation Association, The Yellow School Bus Industry, 2013. Available at: https://s3-us-west-2.amazonaws.com/nsta/6571/Yellow-School-Bus-Industry-White-Paper.pdf.

4

Equity and Intersectionality

In order to achieve broad engagement in the climate emergency, we must be intersectional in our approach; in other words, we must link the climate crisis to human rights in all their forms including—racial justice, indigenous rights, women's rights, immigrant rights, disability rights, and LGBTQ rights. Our public K-12 schools are critical spaces that foster exploration of these human rights and host dialog about how these rights are reflected in the world around us. Today our schools themselves reflect massive inequities that are the result of multiple layers of systemic racism and a regressive system for financing school infrastructure. The result is an environment that disproportionately harms students of color. For example, students—disproportionately young people of color—miss approximately 14 million school days per year due to asthma caused by polluted air.[8] After years of injustice, our frontline communities deserve disproportionate investment to mitigate the impacts of climate change and to prepare for careers in the clean energy economy. The way we will begin to disrupt these harmful, inequitable, and unjust patterns is by taking action within our K-12 schools.

5

Preparing the Next Generation

K-12 schools are the training ground for future leaders and looking through the lens of climate change, that has never been more consequential. Bringing climate change science and solutions into our classrooms is both a moral imperative and a powerfully leveraged tool of transformation. Schools have the potential to shift mindsets towards sustainability and prepare youth to confront the climate challenges and opportunities of the future. In fact, analysis suggests that one year of intensive climate change education has a meaningful impact on lifetime emissions.[9] The results suggest that, if scaled up, the impact of education on emissions reductions would be commensurate with the kind of emissions associated with other interventions such as increased deployment of rooftop solar or electric vehicles.

6

Bolstering Community Resilience

As some communities have already started to explore and embrace, schools can play a critical role in enhancing the resilience of communities. As the devastation wrought by extreme weather events has made clear, our infrastructure is vastly unprepared. It is both pragmatic and urgent that we harden our school infrastructure so that these ubiquitous community assets can fill what will be an otherwise vacant role in many parts of the country of providing essential shelter and services in cases of extreme weather events.

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8 Zahran HS, Bailey CM, Damon SA, Garbe PL, Breysse PN. Vital Signs: Asthma in Children—United States, 2001–2016. MMWR Morb Mortal Wkly Rep 2018;67:149–155.

9 In particular, the study showed that individuals receiving the intervention made individual decisions which resulted a reduction of 2.86 tons of CO2 per year. Cordero EC, Centeno D, Todd AM (2020) The role of climate change education on individual lifetime carbon emissions. PLoS ONE 15(2): e0206266. https://doi.org/10.1371/journal.pone.0206266. See also https://www.brookings.edu/research/empowering-the-us-global-change-research-program-to-further-climate-education-and-training/.

There is no path to addressing climate change that does not involve the participation of K-12 schools. This is an all-hands-on-deck, all-of-the-above moment. Our public schools can contribute meaningfully to our carbon reduction targets; but their most essential role is understood by appreciating that schools are the place where we create the future.

Emissions Estimates and Methodology

The K-12 sector offers a multi-faceted opportunity to reduce emissions that spans existing and new buildings, light and medium-duty transportation, land use, and food waste. A zero carbon future for our schools will require retrofitting existing buildings, embracing new low-embodied carbon materials, onsite renewable energy, and high-performance building systems, transitioning a largely diesel school bus fleet to zero-emission options, reducing the carbon footprint of food services, and managing land use. To understand just one part of the opportunity in K-12, we quantify the current emissions produced by the building operations of the public K-12 sector.

We estimate that the current emissions associated with the operation of public K-12 buildings is approximately 42 MMTCO2e (see Appendix).[10]

The level of emissions per square foot of building space vary greatly by state reflecting both the energy efficiency of K-12 buildings, the use of various fuel types, and the emissions intensity of the power sector. States like Washington and Vermont have the lowest emissions per square foot of K-12 building space while states like West Virginia and Wyoming have the most emissions intensive K-12 buildings.

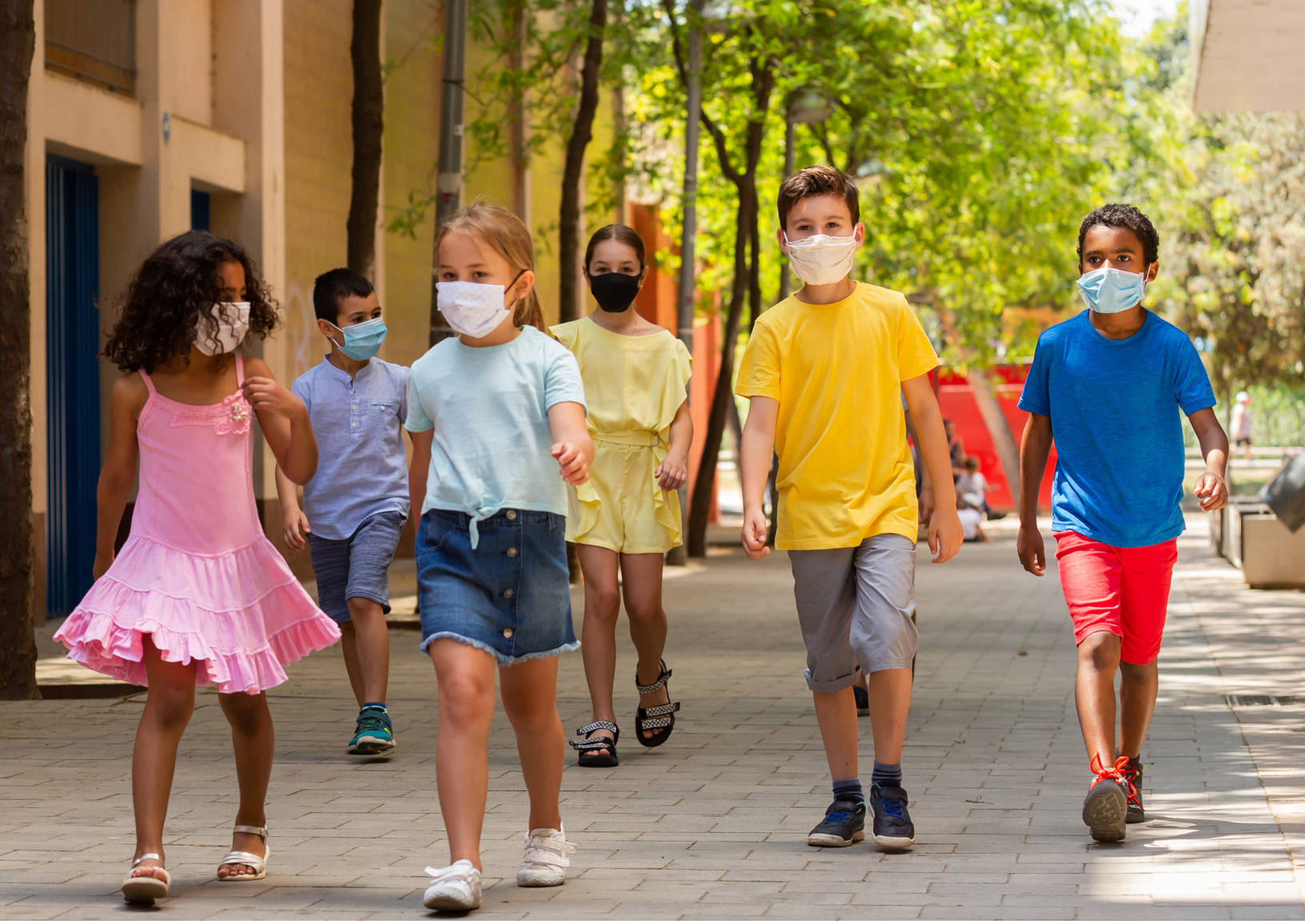
Estimating Building Emissions

In order to estimate the operational building emissions for public K-12 schools by state, we start by estimating energy consumption. We compile data from the National Center for Education Statistics and the State of our Schools to estimate square feet of public K-12 school buildings by state.[11] Public K-12 school buildings represent 7.8 billion square feet of building space, or 85% of all K-12 building space. We use the Commercial Buildings Energy Consumption Survey (CBECS) to capture Census Division-specific estimates of site electricity, natural gas, fuel oil and district heat consumption by K-12 buildings. We calculate average annual energy consumption (for all energy types) per square foot of K-12 building space for each Census Division. We estimate total statewide consumption of each energy type by multiplying our estimate of consumption per square feet by the total square feet of K-12 public buildings in the state.

In order to calculate emissions associated with K-12 schools consumption of electricity, natural gas, fuel oil and district heat, we use 2019 data available from the Energy Information Administration (EIA). To determine the emissions intensity of electricity by state, we divide total carbon emissions

10 Accelerating America's Pledge found that the buildings sector would account for 66 MMTCO2e in 2030 of avoided emissions in their "Bottom-Up" scenario, approximately 4% of the economy-wide total avoided emissions in 2030.

11 NCES data can be found here: https://nces.ed.gov/ccd/pubschuniv.asp. The State of our Schools (2016) may be accessed here: https://bit.ly/3c9P2mA.



by total generation from the electric power sector for each state.[12] We apply the emissions intensity for the electric power sector in each state to schools' site electricity consumption to determine total emissions associated with schools' electricity usage. To estimate emissions associated with schools' consumption of natural gas, residual fuel oil, and district heat we apply the EIA's carbon dioxide emission factors to the Division-specific estimates of usage.[13] The results are state-level estimates of carbon emissions associated with the operations of public K-12 school buildings.

Figure 1: Representation of Emissions Calculations for K-12 Buildings

$$\sum_{\text{Sum across all fuel types } j} \text{K-12 public building sq. ft.}_{i} \times \text{Fuel consumption per sq ft.}_{i,j} \times \text{Emissions per unit of fuel}_{i,j} = \text{Total emissions by K-12 public buildings in state } i$$

12 See US Energy Information Administration, Net Generation by State by Type of Producer by Energy Source (EIA-906, EIA-920, and EIA-923) https://www.eia.gov/electricity/data/state/.

13 See EIA Table A.3. Table A.3. Carbon Dioxide Uncontrolled Emission Factors available here: https://www.eia.gov/electricity/annual/html/epa_a_03.html.

Bright Spots

To achieve our emissions goals, schools must be on a critical path to healthy, efficient, zero carbon design and operation. Zero carbon schools consume only as much carbon-free energy as they produce over the course of the year. According to the New Buildings Institute Getting to Zero Database,[14] there are zero energy and zero carbon schools emerging across the country. Schools are a prime candidate for rapid transformation as the building type and its occupants readily lend themselves to achieving zero carbon. Schools can drive down emissions more readily than other building types because they have good replication potential, are owner-occupied with strong stakeholder involvement, and are prominent in their communities. The mission of schools is tied to the health and productivity of occupants making a strong case for infrastructure improvements. Lastly, schools are often able to redirect utility savings to support direct service in the classroom.

These bright spots provide proof of concept for policymakers and climate leaders that prioritizing schools to deliver on a Nationally Determined Contribution is a viable strategy that will contribute to health, equity, and resilience.

There are currently **91 K-12 schools** spread across 20 states plus DC that are either verified or emerging as net-zero buildings. These states, which include but are not limited to North Dakota, California, Florida, New York, Kentucky, Massachusetts, Texas, and Missouri, are diverse in their climates and their politics. See here.

14 New Buildings Institute Getting to Zero Database: https://newbuildings.org/resource/getting-to-zero-database/.

There are now **7,332 K-12 schools using solar power** nationwide, making up 5.5% of all K-12 public and private schools in the United States. Today, **5.3 million students** attend a school with solar.

The **Salt Lake City District School board** unanimously passed a resolution establishing the goal of transitioning the school district to 100% clean electricity by 2030, and off fossil fuels by 2040. See here.

Warren County Public Schools in **Kentucky** designed the first Net Zero school, Richardsville Elementary in 2010. This school has now been in successful zero energy operation for over a decade. Additional Kentucky school districts followed suit with an additional six zero energy schools completed and several more in the planning stages.

The National Renewable Energy Laboratory developed a case study of **Discovery Elementary in Virginia.** There is also a 7-hour course co-developed with DOE, ASHRAE, AIA, and USGBC about this school.

There are model school district sustainability plans on the Department of Education's Green Strides portal, including this one from **Virginia Beach,** which is focused on emissions.

The Board of Directors for **Seattle Public Schools** voted unanimously to pass a resolution committing the School District to transition to 100% clean and renewable energy by 2040, which requires eliminating all use of fossil fuels in district electricity, heating, cooling, cooking and transportation. See here.

Eleven school districts, three states and ten national organizations from around the U.S. participated in the U.S. Department of Energy Zero Energy Schools Accelerator program. These stakeholders came together to develop district and nationwide plans to scale Zero Energy K-12 schools while enhancing the educational environment for our nation's students.

The **NYC Department of Education** has a comprehensive sustainability plan and achieved 13% GHG reductions during the 2019-2020 school year. See their annual report here.

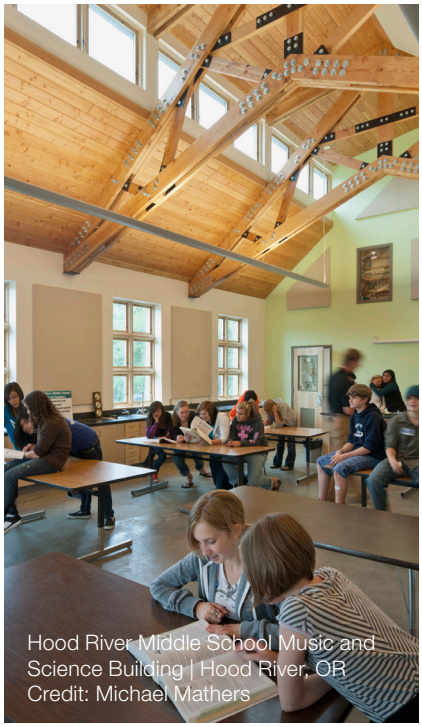
The **Los Angeles Unified School District** committed to the goals of achieving 100 percent clean, renewable energy in its electricity sector by 2030 and in all energy sectors, including heating, ventilation, air conditioning (HVAC), cooking, and transportation by 2040 working in collaboration with the LADWP's Sustainable City Plan. See here and here.

Lake Tahoe Unified School District (LTUSD) adopted a resolution pledging to achieve deep energy and carbon emission reductions in its school buildings. The LTUSD Energy and Carbon Goals Resolution, which passed unanimously at the January 2021 school board meeting, is the first step in a long-term approach to energy management that aims to cut energy use in half and help the district meet the State's goal to achieve economy-wide carbon neutrality by 2045. See here.

Whitefish School District in Montana built a Center for Sustainability and Entrepreneurship, which uses the net-zero facility as a teaching tool.

The **Horry County Schools** board in **Myrtle Beach, South Carolina** solicited an RFP for five new zero energy schools. These schools were designed to only use as much energy as they produce and have been in operation since 2017.

In addition to a district-wide sustainability strategy, **Portland Public Schools** is implementing curriculum and educational opportunities that address climate change and climate justice in all the city's public schools. See here and here.



Hood River Middle School Music and Science Building | Hood River, OR
Credit: Michael Mathers

The **Oakland Unified School District** established the goal of achieving 100% clean electricity by 2030 and phasing out the use of fossil fuels by 2040 toward a broader goal of becoming a carbon-neutral school district that offsets or avoids all carbon pollution generated by their operations. See here.

The **Tennessee Energy Efficient Schools Initiative** is a popular and effective program to reduce energy usage (thus emissions) in schools across the state.

The Philadelphia Energy Authority is supporting energy efficiency work across the **Philadelphia School District.** There are 10 schools currently undergoing energy efficiency work. Pilot schools **reduced energy use by 38%** and created 220 jobs. See here.

Stockton Unified's Energy Conservation Program has saved $15.1 million in the program's first 7 years. The district is leveraging grants and rebates to reduce their carbon footprint and convert to electric buses. See here, here, and here.

San Francisco Unified has board-approved policies and plans to phase out fossil fuel use by 2040. From the Executive Summary of Sustainable SFUSD's Carbon Reduction Plan:

> *As we prepare students for the 21st century in our classrooms, we also want to prepare our facilities for the next 100 years. They should be resilient in the face of future changes to our climate and operated in a way that does not contribute to those changes.*
>
> *That's why SFUSD is embarking on a multi-decade effort to achieve carbon neutrality by 2040. The technology exists to construct buildings that use no more energy than they generate, and all new SFUSD buildings will be built to this standard.*
>
> *In existing buildings, we will gradually replace gas boilers with electric heat pumps. Instead of burning natural gas, our heat pumps will operate using clean, renewable electricity provided by the SF Public Utilities Commission (SFPUC) and by solar panels on our rooftops. Our goal is to achieve a 50% reduction in natural gas usage by 2030 and to stop burning it entirely by 2040. Thanks to past building modernizations, we are already well on our way to achieving these targets.*
>
> *In order to eliminate the use of gasoline and diesel in our vehicle fleet, SFUSD is mandating that all new cars be emissions free and that school buses switch to renewable diesel by 2020. By 2030, we plan to remove our final gas-powered vehicle from the fleet.*

The SEI Energize Schools program hosts school Energy Conservation Competitions. Students are introduced to concepts of energy and power, audit their campus using industry-standards tools, and then utilize their knowledge to design and launch a school-wide campaign to conserve energy.

Figure 2: Findings from Aspen K-12 Climate Action State Policy Landscape 2020 Report

TOPIC	POLICY HIGHLIGHTS
Energy	• **6 states** have policies that target net-zero energy consumption in schools
Transportation	• **45 states**' Volkswagen Mitigation Settlement plans allow funding to be used for electric school buses • **24 states and DC** have policies to reduce school bus idling
Food	• **34 states and DC** have policies or programs to support local food in school meals • **17 states and DC** have policies or programs to support school gardens • **14 states** have policies or programs to encourage schools to divert surplus food waste
Virtual Learning Days	• **13 states** have policies that allow virtual learning days in place of inclement weather days
Career and Technical Education	• **29 states** have career and technical education programs that prepare students for green careers
Science and Social Studies Standards	• **29 states and DC** require teaching climate change as human-caused in science classes • **5 states** require teaching climate change in social studies classes • **16 states** require teaching about sustainability in social studies classes

Redding School of the Arts, Redwood Wall, recycled wood in the southeastern breezeway with the Bird Air skylights overhead | Redding, CA
Credit: TRILOGY Architecture

Policy Resources

Below are resources that discuss policy options to decrease K-12 emissions and catalyze K-12's transformational potential:

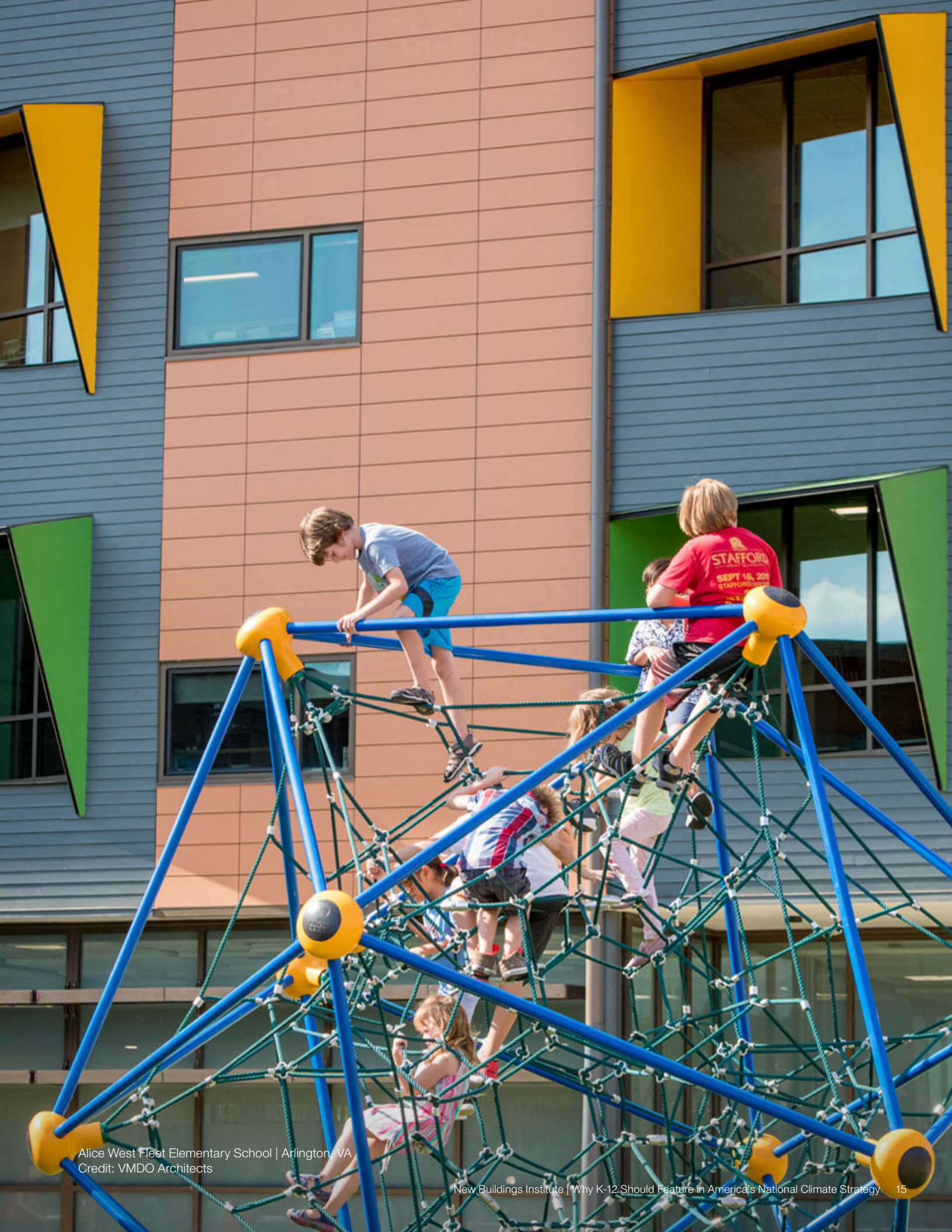
- The ACE National Strategic Planning Framework for the United States is intended to guide the completion of a national strategic plan in time for delivery at the 26th UNFCCC Conference of the Parties in November 2021.
- UndauntedK12's A Climate-Ambitious Agenda for America's K-12 Schools pulls from existing legislation and a diverse set of new ideas, to compile recommendations for federal legislation, executive actions, and regulatory actions aligned with climate-resilient schools, equity, and future-ready students.
- K12 Climate Action at the Aspen Institute's State Policy Landscape 2020 report summarizes current state policies and programs that support sustainable practices to address climate change in schools. In March 2021, K12 Climate Action offered policymakers a framework for School Infrastructure and Career and Technical Education To Build Back Better.
- Center for Green Schools at USGBC: How Congress Can Support Healthy, Green Schools for Safe Reopening, and Greater Equity Across America (2021).
- National Wildlife Federation's Key Elements of a National Policy & Funding Strategy for Equitable Climate Literacy and Related Career and Workforce Development offers specific policy actions that, when combined and coordinated, would create a solid base for delivering equitable and just climate literacy and related job and career development opportunities on a large scale across the U.S.

Appendix
Estimated Annual Public K-12 Buildings Emissions (Operational)*

State	Millions of Building Sq Ft	Annual Emissions (Metric Tons)	Annual Emissions (MT) per Sq Ft
Washington	141	297,195	2,112
Vermont	16	37,665	2,294
Oregon	98	237,584	2,425
Idaho	52	131,999	2,532
California	619	1,625,922	2,626
New Hampshire	32	93,625	2,946
Maine	34	115,431	3,352
South Carolina	120	434,842	3,632
Connecticut	84	314,955	3,747
South Dakota	28	107,626	3,883
New York	445	1,778,815	3,997
Virginia	191	820,905	4,306
Tennessee	171	759,138	4,431
Oklahoma	118	528,502	4,492
New Jersey	199	902,982	4,547
Maryland	143	654,905	4,580
Alabama	117	550,331	4,709
Rhode Island	22	105,913	4,709
Nevada	55	257,391	4,719
Massachusetts	186	879,131	4,728
Illinois	346	1,685,098	4,876
North Carolina	241	1,180,690	4,900
Mississippi	82	408,592	4,971
Arizona	155	785,749	5,056
Pennsylvania	343	1,733,386	5,060
Georgia	246	1,305,419	5,310
Florida	439	2,363,548	5,379
Alaska	34	189,039	5,536
Texas	664	3,909,526	5,885
Kansas	84	497,886	5,958
Minnesota	185	1,134,231	6,134
Michigan	331	2,049,845	6,186
Louisiana	128	798,316	6,237
Arkansas	107	695,748	6,521
Delaware	21	136,118	6,539
Iowa	93	613,753	6,632
Wisconsin	179	1,220,015	6,802
Ohio	305	2,092,416	6,866
Hawaii	21	145,524	6,962
New Mexico	64	447,180	6,966
Montana	29	203,157	7,049
Colorado	132	947,999	7,184
Washington, DC	15	120,856	8,026
Utah	106	889,788	8,372
Nebraska	63	535,984	8,489
Indiana	190	1,622,836	8,555
North Dakota	28	260,059	9,194
Missouri	160	1,536,744	9,623
Kentucky	115	1,148,132	9,983
Wyoming	24	254,176	10,382
West Virginia	37	405,197	10,962
Total	**7,837**	**41,951,864**	**5,353**

* Figures are based on in state generation only and do not include imported and exported energy.

Note: Emissions estimates for Alaska are likely understated here. We are using data on various forms of energy usage by square foot by K-12 schools available at the level of Census Division. Alaska is assigned to Census Division 9 with Hawaii, California, Oregon and Washington. Given the differences in climate, Alaska is likely to use more of certain forms of energy per sq foot of K-12 building space compared to schools in other states in Census Division 9.



Alice West Fleet Elementary School | Arlington, VA
Credit: VMDO Architects

Coalition for Climate Education Policy

Advancing climate literacy for a just and sustainable future

The Coalition for Climate Change Education Policy is working to advance climate literacy and ensure that education is part of the toolbox of solutions to build more resilient and low carbon communities, advance justice and equity, and create a climate-ready workforce. Learn more at climateedpolicy.org

UNDAUNTEDK12

Climate-resilient schools and future-ready students

UndauntedK12 is working to support America's K-12 public schools to make an equitable transition to zero carbon emissions while preparing our youth to shape and build a sustainable future in a rapidly changing climate. We believe the current moment offers an opportunity for action to address inequities, stimulate the economy, enhance critical public infrastructure, and position America to lead the world in the transition to clean energy-driven commerce and community. Learn more at undauntedk12.org

nbi new buildings institute

New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates and building professionals—to promote advanced design practices, innovative technologies, public policies and programs that improve energy efficiency and reduce carbon emissions. We also develop and offer guidance and tools to support the design and construction of energy efficient buildings. Learn more at newbuildings.org