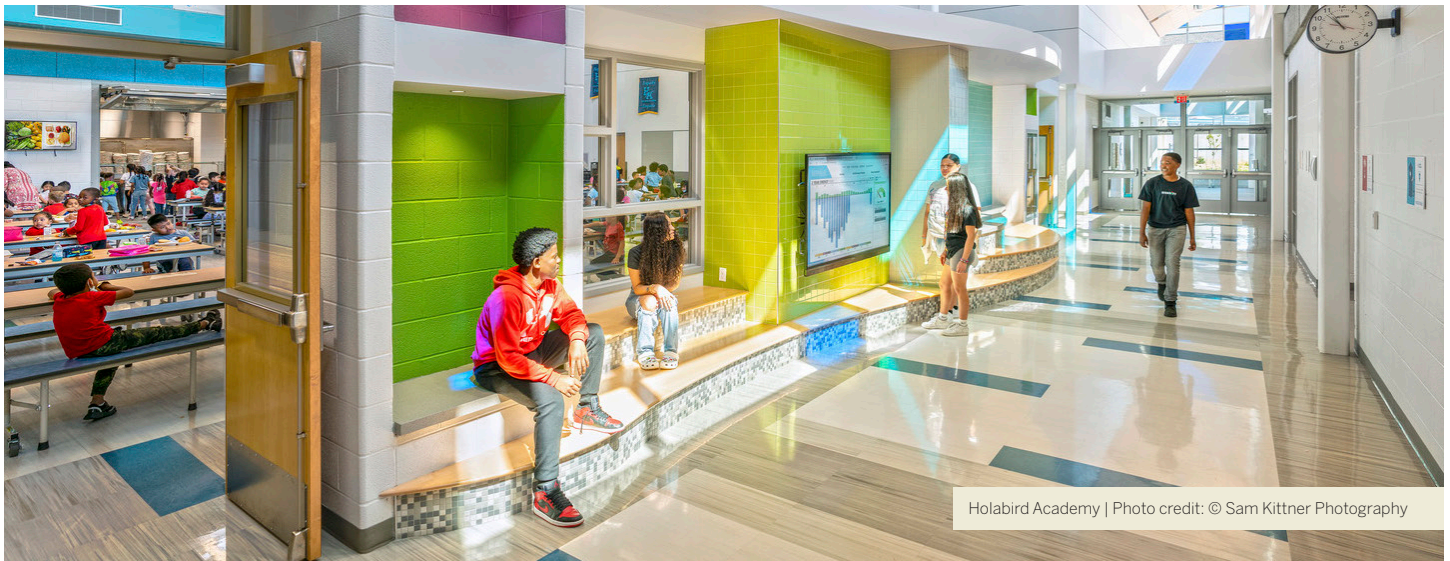


Driving Toward Zero Carbon Emissions in School Buildings



What is building decarbonization?

Building decarbonization refers to **reducing or eliminating carbon emissions associated with buildings** by prioritizing low-carbon building materials, energy efficient design, and transitioning away from fossil fuel-based energy sources towards renewable alternatives like solar, wind, and geothermal.

Why are zero carbon school buildings important?

- **Healthier Indoor Environments:** Energy efficiency improvements like ventilation upgrades, building controls, weatherization, and daylighting also improve indoor environmental quality. Removing fossil fuel combusting equipment (gas stoves and boilers) reduces pollutants in and around the building, which can exacerbate respiratory issues.
- **Climate Mitigation:** Decarbonizing school buildings helps mitigate climate change by reducing buildings' overall contribution to global warming.
- **Educational Opportunity:** Schools that reduce their carbon emissions can serve as living laboratories to teach about energy, emissions, and climate change.
- **Reduced Costs:** Energy-efficient buildings require less energy to operate, leading to lower and less volatile utility costs over time.
- **Resilience:** Modern ventilation systems, renewable energy, and energy storage capabilities prepare schools to operate during climate emergencies.

What is driving building decarbonization?

Community Advocacy: Students, parents, and staff are advocating for school board resolutions to reduce greenhouse gas emissions. Schools for Climate Action tracks [school board resolutions](#).

State and Local Policy: Cities and states are establishing robust energy codes or policies that address building fuel types and emissions. The Building Decarbonization Coalition's [state and local government policy tracker](#) offers a searchable database and map to explore policies.



Photo credit: Courtesy of Acton-Boxborough RSD

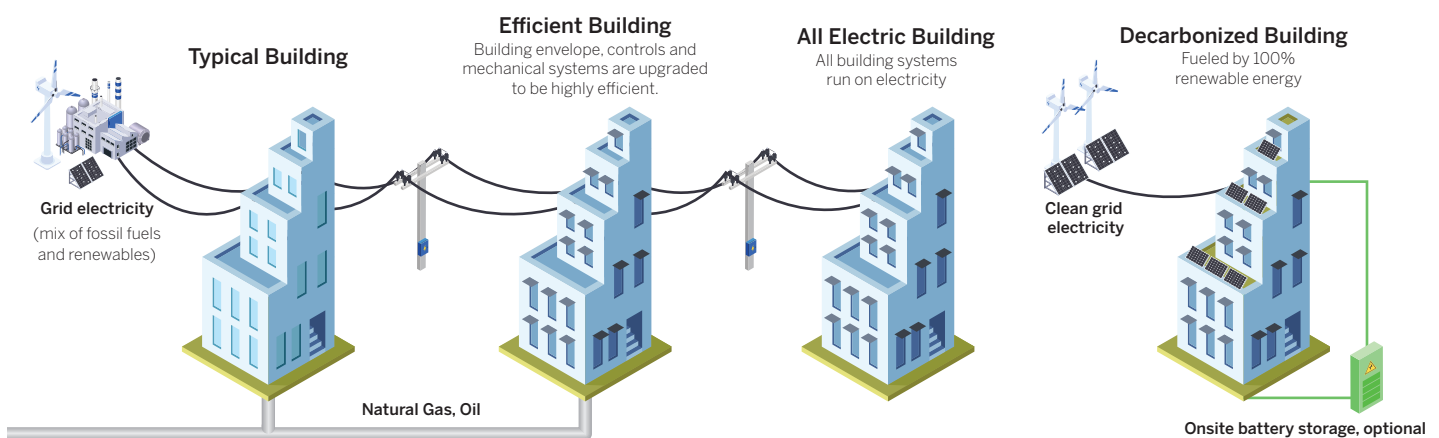
Breaking Down the Terminology

Energy efficient buildings reduce [energy demand](#), which offers significant cost savings. When prioritizing a decarbonized building, efficiency comes first!

Electrified buildings use electricity only (rather than onsite fossil fuels). Electricity can be provided by the utility grid, which is [getting cleaner](#) over time, onsite renewables, onsite battery storage, and hydrogen [fuel cells](#).

Decarbonized buildings have energy efficient systems, run entirely on electricity, and are powered 100% by renewable sources, either onsite and/or through a clean energy grid.

Existing School Building Decarbonization Pathway



"We believe that energy efficiency and solar will be the quickest and most cost-effective ways to achieve our shorter-term [decarbonization] goals, and that building electrification will be the most effective way to meet our long-term goals. Success will also depend on the utility companies meeting their own targets around providing clean electricity." – Aaron Presberg, Portland Public Schools



Common Myths Around Decarbonization

Myth: Getting off fossil fuels and transitioning to electric heating and cooling is impossible in colder climates.

Modern electrified HVAC systems leverage very efficient heat pump technology (air-source and ground-source) to provide heating or cooling in one system. [Research](#) shows that cold climate heat pumps can outperform conventional fossil-fuel heating systems, operating at 300 - 400% efficiency and providing dependable heat even in temperatures below -20°F.

Myth: Our school building stock is mostly existing, and we are not building new schools. Decarbonizing our schools will be too costly and will take forever.

Schools can make meaningful progress toward decarbonization without excessive cost or delay by developing a [Roadmap to Zero](#) that prioritizes energy efficiency, targeted HVAC and cooking upgrades, and gradual renewable energy installation. Federal and state funding is available for weatherization, clean energy, and efficient heat pump technology, making the transition more accessible and affordable for schools.



Myth: Decarbonized schools require building envelopes to be tightly sealed, worsening indoor air quality.

While efficient buildings are often tightly sealed to minimize energy loss, advanced ventilation systems, such as energy recovery ventilation, can ensure adequate airflow and maintain high indoor air quality. Additionally, tightly sealed buildings prevent moisture and pest intrusion.

Myth: Electrifying buildings is pointless if fossil fuels primarily power the utility grid.

Transitioning to electric systems makes sense even if the utility grid currently relies on natural gas and coal for power generation. Firstly, electric systems will become more [financially reliable](#) as the utility grid [continues shifting](#) towards renewable energy sources. Also, electric systems are often more efficient than their fossil fuel counterparts, resulting in lower operating costs and reduced environmental impact.

Journey to Decarbonization: Profile of Acton-Boxborough Regional School District

The Acton-Boxborough Regional School District (ABRSD), serving 5,000 students and operating eight school buildings, is situated just west of Boston. Building on long-standing energy conservation work, led by its visionary energy manager, the district is moving from efficiency towards electrification, in line with a Massachusetts goal of net zero greenhouse gas emissions by 2050.



Embarking on decarbonization at your school or district might seem like an insurmountable task, but following these basic steps, which are underway at ABRSD and other districts nationwide, can help you get started on your journey.

Manage energy consumption and understand your baseline

ABRSD has aggressively pursued energy conservation and efficiency, achieving more than a 30% reduction in electricity and natural gas use over the 2009 benchmark year. Key efficiency efforts include lighting, mechanical and ventilation system upgrades, weatherization projects and [behavior-based strategies](#).

Additional examples include [Ann Arbor Public Schools](#) (MI), [Des Moines Public Schools](#) (IA), [State of Kansas](#)

Establish sustainability or climate action policies

ABRSD school board adopted a general sustainability policy in 2017, which both students and faculty were involved in creating. The Town of Acton adopted a Climate Emergency Declaration in 2020, calling for net zero carbon emissions as quickly as possible, with a target date of 2030.

Additional examples include [Boulder Valley School District](#) (CO), [Denver Public Schools](#) (CO), [Fenn School](#) (MA), [Portland Public Schools](#) (OR), [Salt Lake City School District](#) (UT)



Develop a decarbonization roadmap

ABRSD commissioned an [Electrification Roadmap](#) study in partnership with the Town of Acton in 2022, which outlines a strategic timeline and costs for electrifying existing school and municipal buildings over the next two decades. In addition, a [Life Cycle Cost Analysis](#) studied the impact of replacing aging gas-fired HVAC rooftop units. For the district, opting for all-electric rooftop units promises substantial financial benefits and will contribute significantly to reducing greenhouse gas emissions.

Additional examples include [Denver Public Schools](#) (CO), [NYC School Construction Authority](#) (NY), [Portland Public Schools](#) (OR)

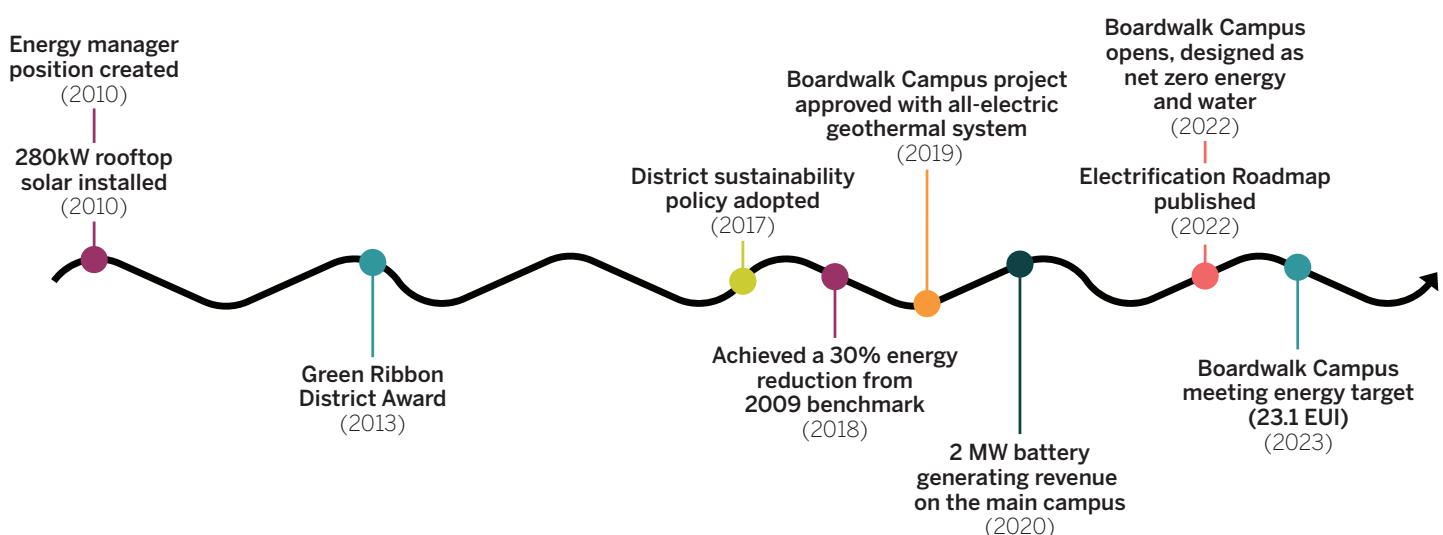
Put the plan into action: system replacements, building retrofits, and new construction

ABRSD installed an advanced battery storage system on its main campus in 2020, generating an impressive \$70,000 in annual revenue and cost savings while also contributing to regional electricity grid support and stability.

The district's new Boardwalk Campus, a 175,000-square foot, all-electric geothermal school building serving 1000 elementary school-aged students, is designed to be zero energy and zero water and is more cost-effective to operate than traditional gas-fired buildings. The large onsite solar array and battery storage system, planned to come online soon, aims to make the building net zero energy, providing onsite power generation to meet all the building's energy needs without greenhouse gas emissions.

Additional examples include [Cobb County Schools](#) (GA), [Loudoun County Public Schools](#) (VA), [Warren County Board of Education](#) (KY), [Salt Lake City School District](#) (UT)

Acton-Boxborough's Journey to Zero Carbon



RESOURCES

More on Building Decarbonization

[Decarbonization Issue Brief](#) (US Green Building Council)—Overview of the USGBC's key definitions, issues and policy priorities around decarbonization of buildings.

[National Definition of a Zero Emissions Building](#) (Dept of Energy)—The federal government published a national definition of a zero-emission building to establish consistency in the market.

[HVAC Choices for Student Health and Learning](#) (Rocky Mountain Institute & UndauntedK12)—A report outlining what policymakers, school leaders, and advocates need to know about all-electric, high-performance HVAC systems.

Building Decarbonization Planning & Action

[School Decarbonization Roadmap](#) (New Buildings Institute)—A roadmap that outlines achievable goals that result in healthy, affordable, all-electric facilities and explains everyday actions taken by leading districts to operationalize their carbon-neutral ambitions.

[Advanced Energy Design Guide](#) (ASHRAE)—A guide that provides case studies, technical examples and how-to tips to address specific project needs, including building and site planning, envelope, daylighting, electric lighting, plug loads, kitchens and food service, water heating, HVAC and renewable generation.

[Zero Emission Building Ordinance Database & Map](#) (Building Decarbonization Coalition)—Website database and map that track state and local policies defining building emission requirements.

[School Board Member Climate Action Toolkit](#) (This is Planet Ed, UndauntedK12, School Board Partners)—A toolkit that supports school board members to understand their role in driving meaningful climate solutions.

Funding for Clean Energy and Energy Efficient School Buildings

[Fact Sheet: IRA Tax Credits Can Fund School Facilities Upgrades & Reduce School District Energy Bills](#) (U.S. Department of Treasury)—A fact sheet outlining benefits of IRA tax credits for k-12 school building projects.

[Tips for Leveraging Federal Funding for School Buildings](#) (Center for Green Schools)—A one-page document outlining key funding opportunities for green schools.

[Affordable Zero Energy K-12 Schools: The Cost Barrier Illusion](#) (NREL)—A research report on the actual costs of zero energy school projects from around the US.