Decarbonization in Education

A Practical Approach for the Built Environment

By John Holbert | Laura Hagan | Adam McMillen | Doug Sitton

Many of today's educational leaders are looking to implement decarbonization projects at their college or university campus, K-12 district, or individual school building. Such efforts are part of the global movement to reduce operational carbon emissions and **embodied carbon,** and can seem daunting. But with a basic understanding of the key components, steps, planning, and available guidance and funding opportunities, the decarbonization process becomes clearer and incrementally achievable.

The goal of this guide is to foster understanding of the decarbonization process and provide a general path forward. The information that follows offers an overview of the carbon problem and provides thoughtful, measured, and practical ways to reduce and eventually eliminate carbon emissions from your building or campus and offer information that can help overcome the obstacles you may face on this journey.

IMEG

The net-zero Prairie Trails School in Mount Prospect, IL, was named a U.S. Department of Education Green Ribbon School and in 2024 received a 2024 Best in Class – Retrofit Revolutionary Award from the U.S. Department of Energy's Efficient and Healthy Schools Program.

The end goal: Net zero

Carbon-based energy sources, such as coal, oil, and natural gas, drove the Industrial Revolution, power our homes and businesses, and have allowed humans to travel further and faster. But the unchecked use of these fuels and their evolution has been scientifically proven to have caused increases in carbon dioxide (CO_2) in the atmosphere, changes to our environment, and increases in health issues like lung disease. To course correct, we need to decarbonize on a global scale—removing or reducing the output of CO_2 into the atmosphere. This is achieved by moving away from burning carbon-based energy and choosing renewable energy sources instead—like wind and solar-powered electricity—to heat and cool our buildings and run our factories. It also means lowering the level of embodied carbon by choosing lower carbon materials throughout a building's life cycle.

The goal of decarbonization in buildings is to reach **net zero operations**—in which the building produces enough renewable energy to meet its own annual energy requirements—and **net zero embodied carbon**, in which upfront carbon is minimized and the remaining embodied carbon is reduced or offset.

Aside from environmental reasons, however, many other motivators are driving the decarbonization movement, any or all of which may play a factor in your educational organization's decarbonization journey.

These motivators include:

- **Decarbonization mandates.** Twenty-four states, plus the District of Columbia and Puerto Rico, have passed legislation with 100% clean energy goals, according to the **Clean Energy States Alliance**. In addition, many educational institutions have their own carbon reduction mandates; 1,100 institutions also have signed on to the **Race to Zero campaign** with the goal of eliminating their carbon emissions by 2050.

- **Lower energy costs.** **Second only to salaries** for K-12 public schools, energy costs now account for about 22 percent on average, nationally, of school district maintenance and operation costs. Adopting renewable energy may go a long way toward reducing that percentage in the long run.

- **The eventual decarbonization of the grid.** Utilities across the country are gradually moving away from carbon-based energy, like gas and oil, to power grids with clean energy, like solar, wind, and nuclear. That means electricity-based building systems eventually will be carbon free. Building owners still using gas-burning HVAC and other equipment and appliances, however, could end up locked into these carbon emitters for another generation.

- **Improved space utilization.** Many higher education leaders are studying how space is used across campus, seeking to maximize efficiency and minimize energy use. A comprehensive decarbonization effort is the perfect time to address this. These studies can help reduce future emissions and embodied carbon by uncovering spaces that can be adapted or reused—or consolidating what may be spread across multiple spaces into one space—rather than adding a new building to campus.

- **Recruitment.** The generations now entering college see stewardship and sustainable practice as a must-have, not a nice-to-have. They expect higher education officials to lead by example. Reducing the carbon footprint of your campus will be vital for attracting these students.

- **Improved learning environments and public health equity.** Studies show students perform more poorly in older, sub-standard buildings. (According to a study from the Harvard T.H. Chan School of Public Health, for example, students in New York City schools were 12.3 percent more likely to fail an exam on a 90-degree day than on a 75-degree day.) Poor indoor environments also contribute to conditions that spark respiratory illness, leading to more sick days for students, faculty, and staff.

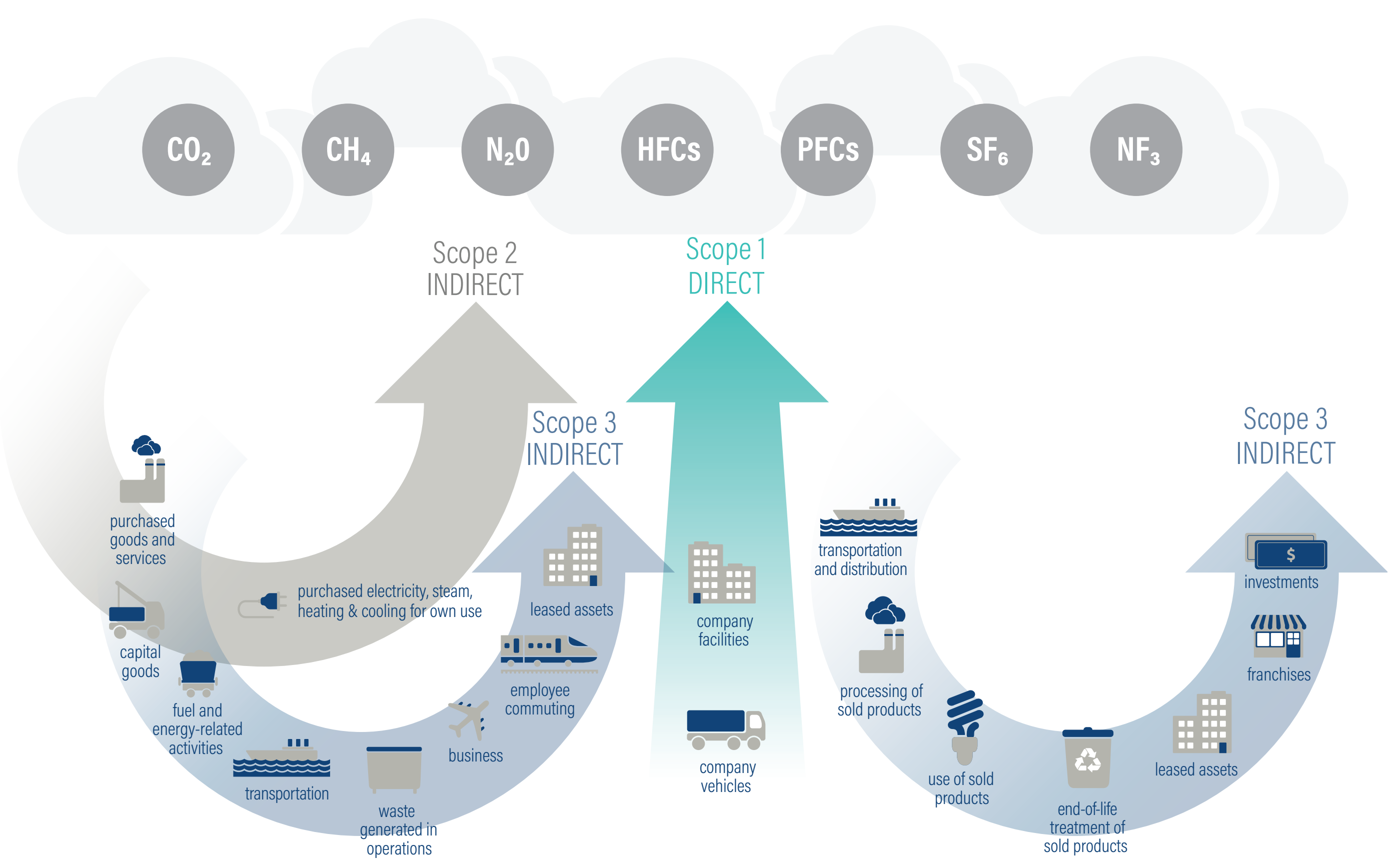
- **Overdue maintenance and upgrades.** Decarbonization and the attendant funding opportunities can provide a practical path toward addressing much of the estimated **$76.1 billion** backlog of building repairs, renovations, replacements, and technology upgrades that exists in the education sector, where school buildings are nearly 50 years old on average.

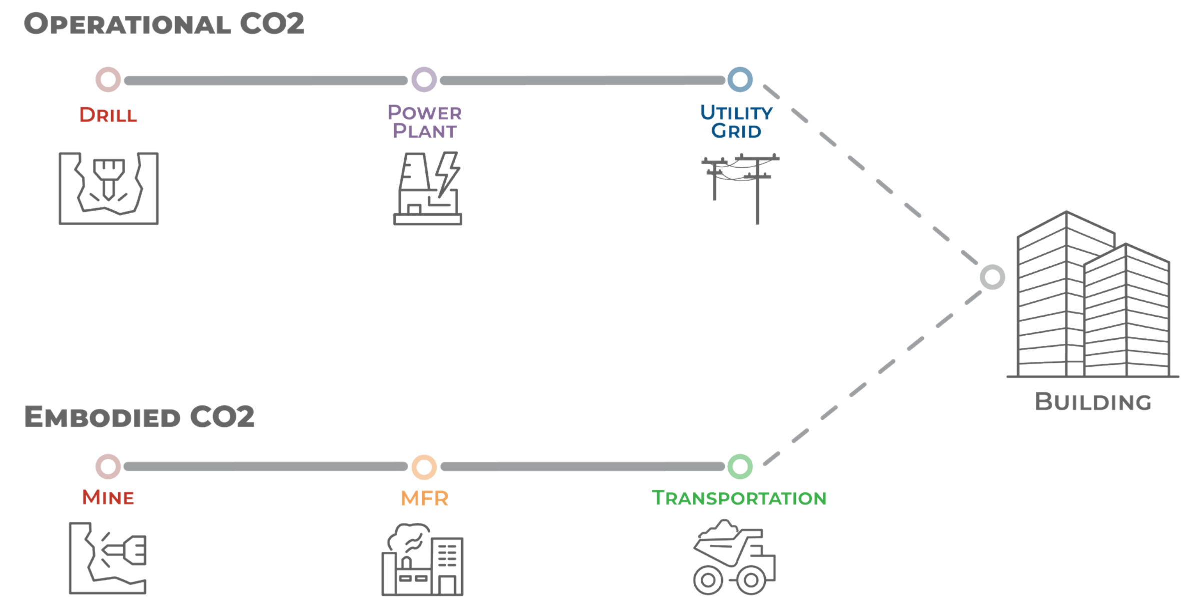
Campuses and school districts may face hurdles as they work to decarbonize, including other educational priorities, limited financial and staffing resources, emerging technologies, regulations, and a changing educational landscape. But by investing in net-zero-ready new construction, choosing lower-carbon materials, and retrofitting school buildings and campuses to use less space and less (and cleaner) energy, educational leaders can shrink their operational and embodied carbon footprint, create healthier spaces, and free up money in the budget to support learning.

Operational and embodied carbon

In the built environment, carbon emissions come from two main sources: operations (i.e., energy use) and materials (such as construction materials), both of which contribute to the carbon problem. Greenhouse Gas Protocol has organized carbon reduction into three scopes that have become the standard language in the field.

- **Scope 1**: Emissions produced on site, like from a gas water heater. These emissions are part of the built environment and can be reduced or replaced with Scope 2 emission sources.





- **Scope 2**: Emissions produced off site, but related directly to consumption on site, like grid electricity produced by burning carbon-based energy at power plants. These emissions, also part of the built environment, can be reduced or replaced with renewable energy sources (like solar, wind, or geothermal).

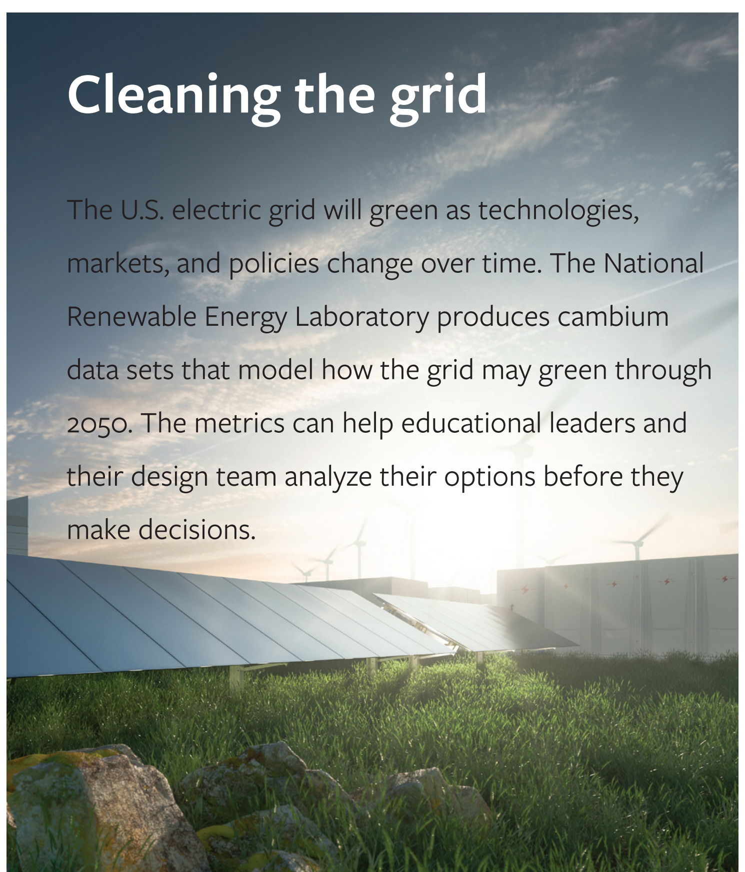
- **Scope 3**: Emissions produced off site as part of a building's supply chain, and which, in the built environment, are referred to as embodied carbon. This includes emissions from the building material stream and from trucks and ships transporting materials and supplies to the facility.

Operational carbon emissions (Scopes 1 and 2) in the built environment are caused by greenhouse gases generated during daily activities. In schools and on campuses, these emissions mostly result from heating and cooling water and air, typically by burning carbon-based energy. Even when schools and campuses don't burn carbon-based energy on site and rely entirely on grid electricity, about 61 percent of the grid is currently supported by carbon-based fuels. This means that every computer, lightbulb, and heating system in a school adds to the building's carbon footprint unless steps are taken to use electricity from renewable sources.

Embodied carbon (Scope 3) is less obvious. It consists of the greenhouse gases created by the carbon emissions it took to build and furnish the building and to dispose of the materials at the end of their lifecycle. It's a long chain—extracting the raw materials from the earth; manufacturing, refining, or fabricating them into building materials; moving the materials to the construction site; running the construction machinery to install them; and tearing the building down at the end of its lifecycle and reusing, recycling, or landfilling the remains.
It also includes the carbon-based fuel it took to manufacture, ship, and install the building's

mechanical equipment, appliances, architectural design elements, and furnishings.

The design and construction industry has become skilled at calculating how much electricity, oil, or natural gas a building uses during its lifetime. However, it's harder to determine how much gas was burned to run the backhoes and cranes during construction, to make steel beams and plaster, or to manufacture the carpet squares that will go in a space. Current estimates suggest, however, that the embodied carbon generated in the year or two leading up to occupancy is as significant a portion of a building's total carbon footprint as 10 to 20 years of operational carbon.



Cleaning the grid

The U.S. electric grid will green as technologies, markets, and policies change over time. The National Renewable Energy Laboratory produces cambium data sets that model how the grid may green through 2050. The metrics can help educational leaders and their design team analyze their options before they make decisions.

Once construction is complete and the building opens, there's no way to reduce its embodied carbon. But the impact can be reduced by working with your design team during the beginning of the planning stages to choose lower embodied carbon materials. While this adds extra work, a **2021 report** found that reductions in the range of 19% to 46% of upfront embodied carbon added little to no additional cost to construction.

Putting decarbonization into practice

Whether you are planning a new building or upgrading an existing building or campus, addressing the carbon problem can seem overwhelming; a new net-zero or net-zero-ready building is a significant undertaking, and a long-term decarbonization plan for a campus can take decades to complete. The important thing is to commit to reducing carbon and create a plan to make incremental changes, using each project's energy savings and lessons learned to springboard to the next project. By aligning your capital investments with your decarbonization goals, you can avoid costly mistakes that your school, district, or campus would be tied to for years.

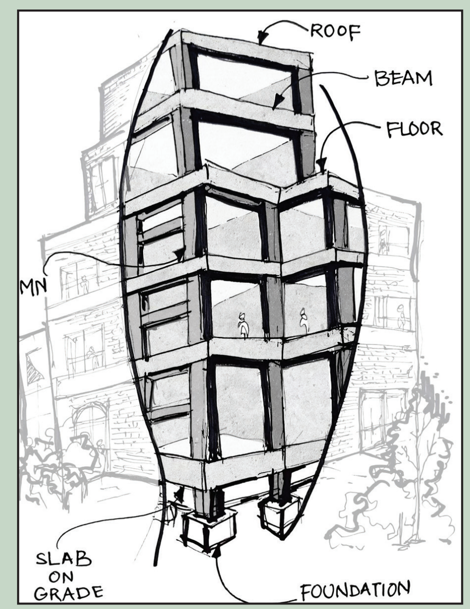
It helps to assign a decarbonization champion or team of champions to lead this effort and set several goals, such as 50% operational carbon reduction by 2030, net-zero emissions by 2050, 20% embodied carbon reductions for all new construction, and up to 50% embodied carbon reductions for building renovations.

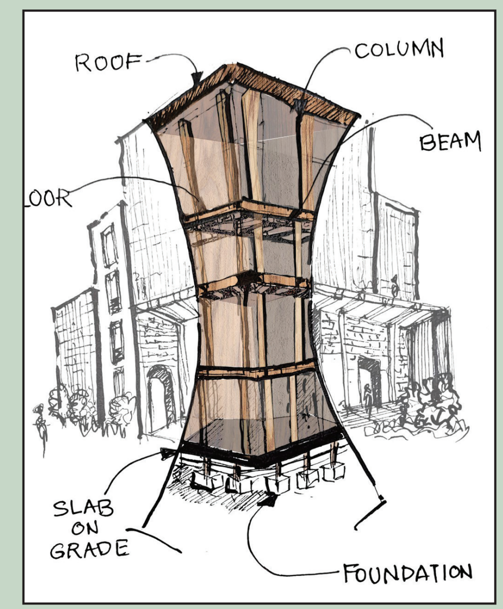
Depending on your situation you may work on two fronts at the same time—optimizing existing buildings while addressing decarbonization as new buildings are designed and constructed (the best time to do so). Modeling tools like IMEG's **EcoMeter** can assist by showing how different materials and engineering measures—structural, civil, mechanical, electrical, and plumbing—will reduce the operational and embodied carbon footprints of new buildings, retrofits, or expansions.

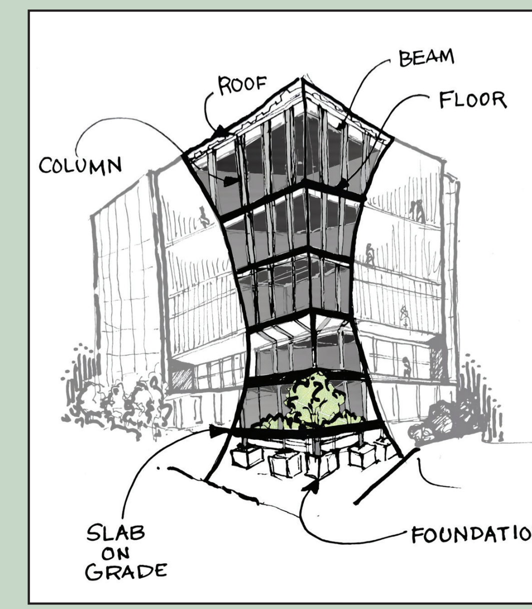
REDUCING EMBODIED CARBON

In general, a building's structure and substructure materials—concrete, structural steel, timber, and insulation—account for much of the project's embodied carbon. But your design team has strategies to reduce this load throughout the design and construction process. They include:

- Whole-building design: Considers embodied carbon from the earliest planning stages and designs to minimize waste. Questions to ask include:
  - Can existing buildings be renovated instead of building new?
  - Can a new project's square footage be reduced?
  - Are there more efficient structural systems or alternative building techniques available, like using prefabricated components?
- One-for-one material substitution: Replaces higher embodied carbon materials with lower ones that meet the same functional requirements.
- Specification: Sets a goal for reducing the global warming potential (GWP) of certain materials. For example, concrete can be mixed in ways that reduce its embodied carbon while still meeting the strength requirements needed for the project. These changes may lead to longer cure times and other changes in the process.







A four-step approach

To begin the decarbonization journey, we recommend a four-step approach: 1) Assess your carbon footprint, 2) Optimize building performance, 3) Implement electrification, 4) Design for and/or integrate renewable energy. The following sections provide an overview of each step and highlight any differences between new construction and existing buildings.

STEP 1: ASSESS YOUR CARBON FOOTPRINT

To reduce your carbon footprint, you first must quantify it—as it is now in the case of existing buildings or what it is anticipated to be for new construction.

EXISTING BUILDINGS

Analyze your building or buildings' carbon emissions and how your portfolio might change over the next 30 years. Start by gathering, reviewing, and documenting relevant data. This should include:

- Building size(s) and use(s)
- Ownership status (owned, leased, subleased)
- Utility supply and demand, including central utility plants, if applicable
- Equipment inventories, including efficiencies, ages, and equipment health
- Building automation systems
- Plans and processes—ESG/sustainability, strategic, master, annual capital, facilities maintenance, design standards, etc.

CALGreen

In 2024, California adopted new building codes to limit embodied carbon emissions in large buildings and school buildings. The changes limit the embodied carbon emissions in the construction, renovation, or adaptive reuse of buildings of 100,000-sf or larger, and school projects of 50,000-sf or larger.

The code offers owners and developers three paths to compliance:

- Reuse of at least 45% of the existing structure
- Using materials that meet an emission limit guidance for five high impact materials
- Using a Whole Building Lifecycle Assessment analysis (WBLCA) with a 10% improvement over baseline. A structural engineer conducts a WBLCA to supply data on the embodied carbon of the building materials used in building construction. It helps clients understand and compare the potential embodied carbon of the structural design options.

A structural-focused Embodied Carbon Study early in a project can supply crucial data and insight on the materials and applications being considered before the project reaches initial milestones.

Gathering and analyzing your utility bills is critical to understanding each building's energy use, which can then be translated into carbon emissions, based on the makeup of the local grid. This data then allows you to identify the buildings with the highest emissions. These should then be the priority buildings as you start the decarbonization process, since reducing their emissions will have the largest impact on reducing your overall campus carbon footprint.

NEW BUILDINGS

To assess the expected carbon footprint of a building in planning and development, owners can turn to benchmarking, which provides industry-wide-available energy data for buildings of similar type and programming. Energy modeling can then be used to provide the building's expected energy use intensity, which can then be translated into carbon emissions based on the makeup of the local grid.

Don't forget about embodied carbon, which has a big impact on a building's carbon footprint and can only be addressed prior to new construction. Embodied carbon mandates also are beginning to appear—California, for example, has adopted new building codes to limit embodied carbon emissions in large buildings and school buildings—and other states and municipalities may follow suit.

Conducting a **Whole Building Lifecycle Assessment** (WBLCA) is a great way to help you understand a proposed new building's embodied carbon.

BENCHMARKING 101

- Document two to five years of annual electricity, gas, water, and central plant (district) energy consumption and costs for each building in your portfolio
- Convert each utility source into an operational carbon number, using tools like the **EPA Power Profiler** for electricity and the **Greenhouse Gases Equivalencies** page for natural gas.
- Identify buildings with the highest energy usage per square foot by calculating their **Energy Use Intensity** (EUI)

STEP 2: OPTIMIZE BUILDING PERFORMANCE

Once you have assessed the carbon footprint of your existing building or campus or benchmarked the expected footprint of a planned building or future capital project, it's time to optimize their performance—and thus reduce their energy use and carbon footprint. Approach this step from a whole carbon perspective including mechanical, electrical, and plumbing, structure, envelope, and site carbon impacts.

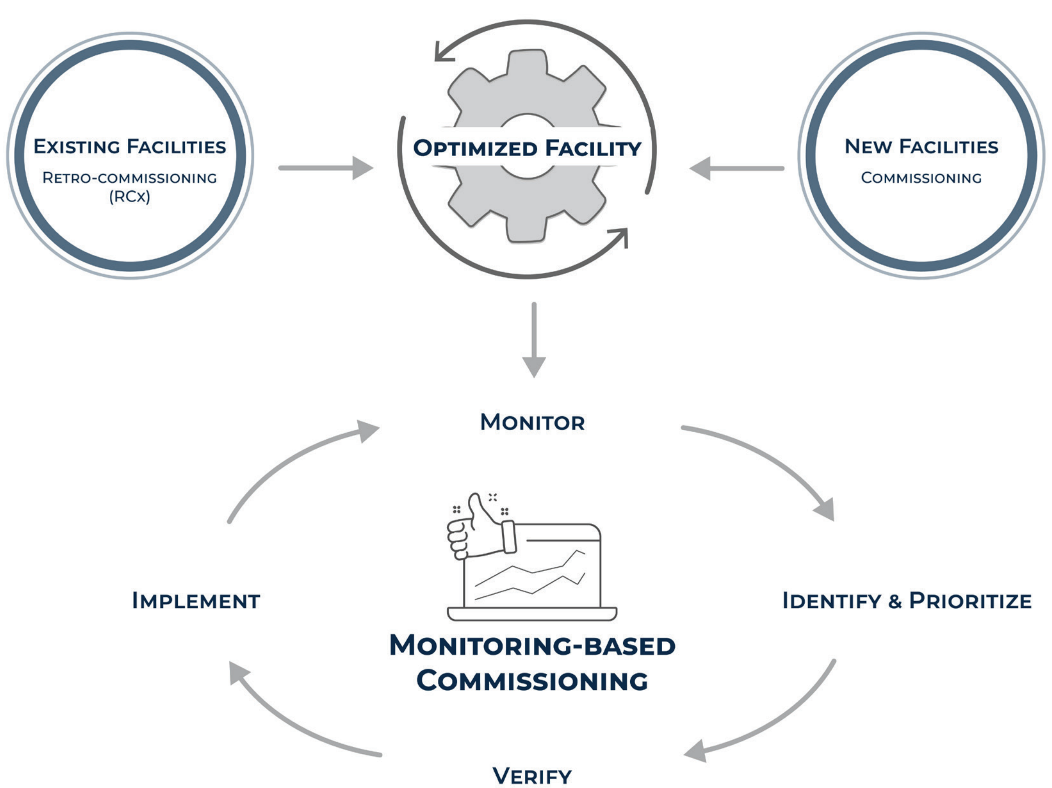
Commissioning and retro-commissioning are key to building optimization and help you find and correct energy waste due to sub-par performance of mechanical equipment. Both strategies are quality assurance processes that involve a series of observations, testing, and corrections to ensure that all building systems are operating and performing as intended and designed.

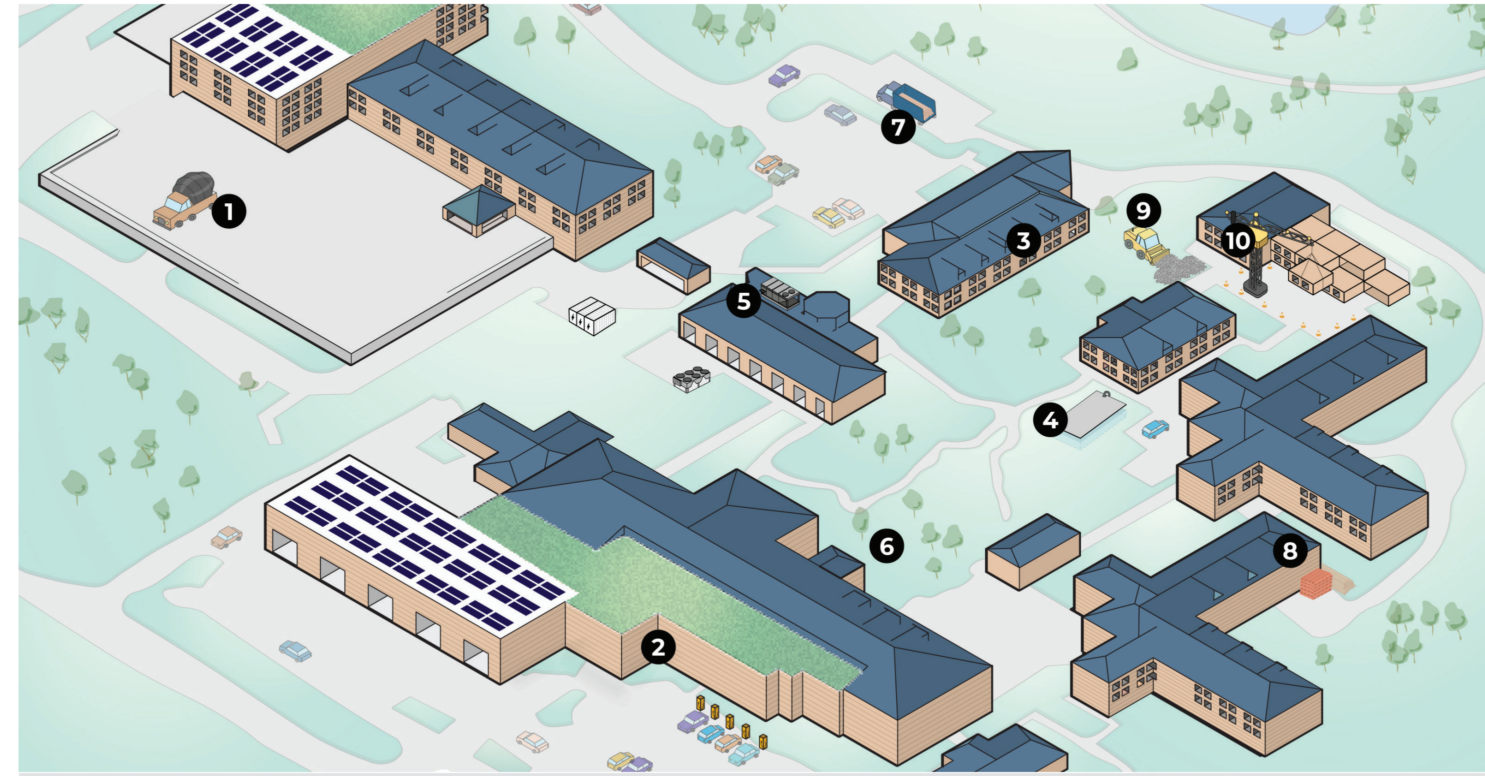
Commissioning and retro-commissioning findings and annual capital programming are used to plan more significant energy efficiency improvements. These can save an added 10% to 15% annually, with a three- to seven-year payback. Key steps include:

- Establishing or updating design standards
- Setting project performance targets
- Modeling performance during design (for new buildings)
- Monitoring and analyzing ongoing performance

EXISTING BUILDINGS

Retro-commissioning examines the operations and energy use of existing buildings. Corrections are then made should a building be found to not be performing as intended. This enables you to eliminate unnecessary energy use—a crucial first step to reducing a building's carbon footprint. By cutting down on energy waste, you quickly see a return on investment. In the best-case scenario, the savings can then be reinvested in further improvements that are more capital-intensive and impactful, such as a renewable energy program.





10 STRATEGIES FOR LOWER ON-SITE EMBODIED CARBON

1. Low embodied carbon concrete for pavement, roadways, and structures
2. Mass timber or recycled steel for buildings and structures
3. Strategic building orientation to optimize solar gain in winter. This results in smaller, lower embodied-carbon HVAC equipment.
4. HDPE piping and retention for stormwater systems
5. Low/zero-carbon refrigerants
6. Trees, shrubs, shrubs, rain gardens, and green roofs to sequester carbon
7. Use of local building materials
8. Reuse of materials such as brick, metal, and wood
9. Construction site optimization (e.g., minimizing earthwork and idle truck and pump time; site layout that minimizes on-site transportation)
10. Modular construction

NEW BUILDINGS

For new construction, optimizing your project's performance often involves evaluating passive and active design strategies that can be implemented to reduce energy consumption, energy costs, and carbon emissions. Development of an energy model to analyze each strategy is a great way to prioritize which optimizations will make the most impact on reaching your decarbonization goals. The graphic above outlines key strategies that can be applied across all aspects of project design and construction.

Commissioning new projects begins in the design phase and continues through construction and activation. Optimizing the performance of new projects in design also often includes energy analysis to evaluate passive and active design strategies.

It is also important to prioritize embodied carbon reduction early in the design of a new building. A **structural-focused embodied carbon study** is a powerful complement to a **WBLCA** or as a stand-alone calculation. When done early in the design phase, this provides crucial data and insight on the materials and applications being considered before the project reaches initial milestones.

HDPE products provide a lower-embodied carbon option for piping and retention systems.

Civil engineering strategies—both in material selection and sequestration opportunities—also should be considered as part of a holistic decarbonization plan. For example, HDPE piping has 52% less embodied carbon than either concrete or steel piping, and 36% less embodied carbon than PVC piping. Sequestration strategies, while they don't lower a building's embodied carbon, can serve as an offset of sorts to a building's carbon footprint by removing carbon from the atmosphere and putting it back into the ground. Examples include green roofs, bioretention facilities (which also help with stormwater management), and the incorporation of new landscaping (trees and shrubs).

Long-term capital projects and infrastructure upgrades also should be reviewed for energy efficiency and embodied carbon reduction strategies. For example, optimizing framing layouts and using biophilic and recycled materials in new construction and renovations can reduce a building's embodied carbon. Information and analysis of this data will help inform Steps 3 and 4.

CAPITAL ENERGY EFFICIENCY MEASURES*

- Converting constant volume to variable volume
- LED lighting upgrades
- Demand control ventilation
- Variable exhaust
- Exhaust air energy recovery
- Chiller plant optimization
- Converting primary CHW pumps to variable
- Converting steam boilers to HW
- Boiler burner upgrades
- Steam trap survey
- Pneumatic to DDC upgrade with scheduling and resets (AHU and space)

* Not all-inclusive

STEP 3: ELECTRIFICATION

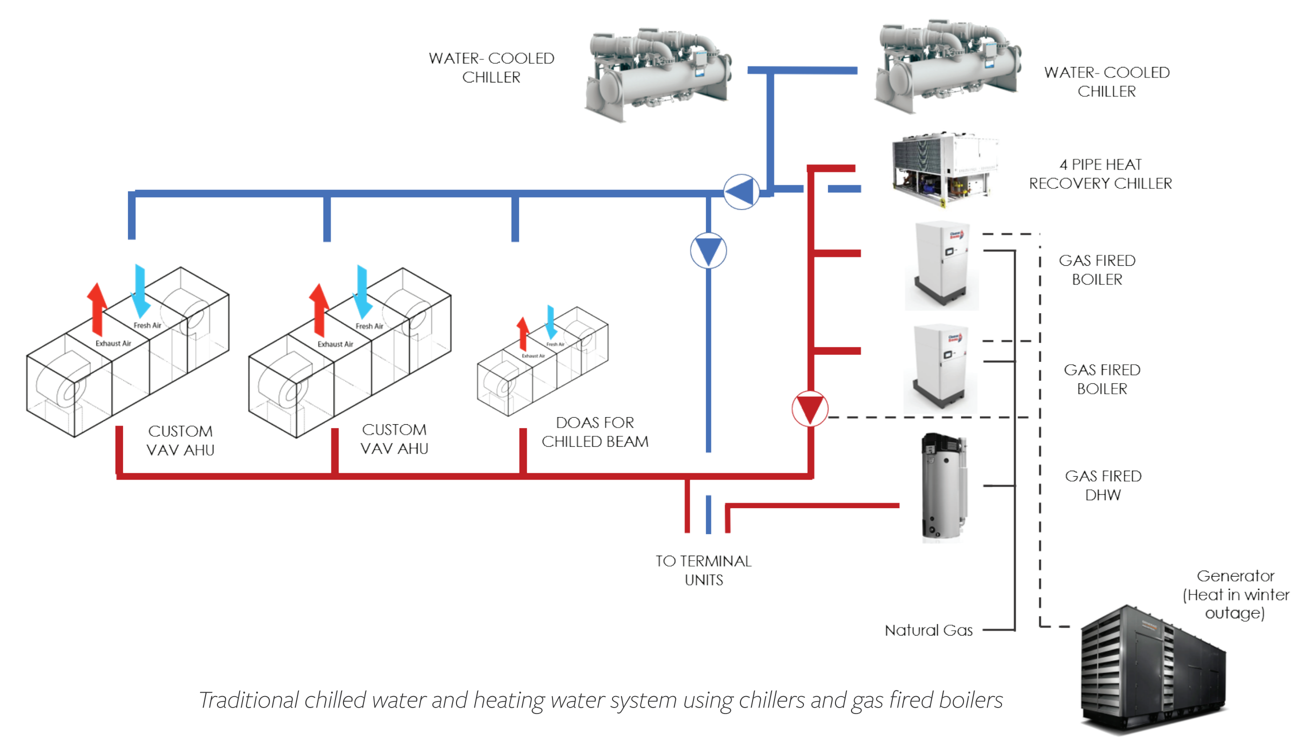
Carbon-based energy is used across districts and campuses for operations like heating and cooling buildings, running school buses, and operating equipment in university research laboratories. In fact, U.S. schools combined are the third largest consumer of commercial building energy—the majority of it from the burning of carbon fuels. "Electrification" refers to the use of electric systems for operational needs—gradually reducing or eliminating the use of oil and natural gas energy.

In a typical existing building, about two-thirds of carbon emissions come from carbon-based electricity and one-third from gas. To decarbonize, buildings and campuses must switch to electric systems that can be powered by renewable energy. This means replacing all appliances that burn carbon-based energy—oil and gas furnaces, water heaters, boilers, and dryers—with electric versions.

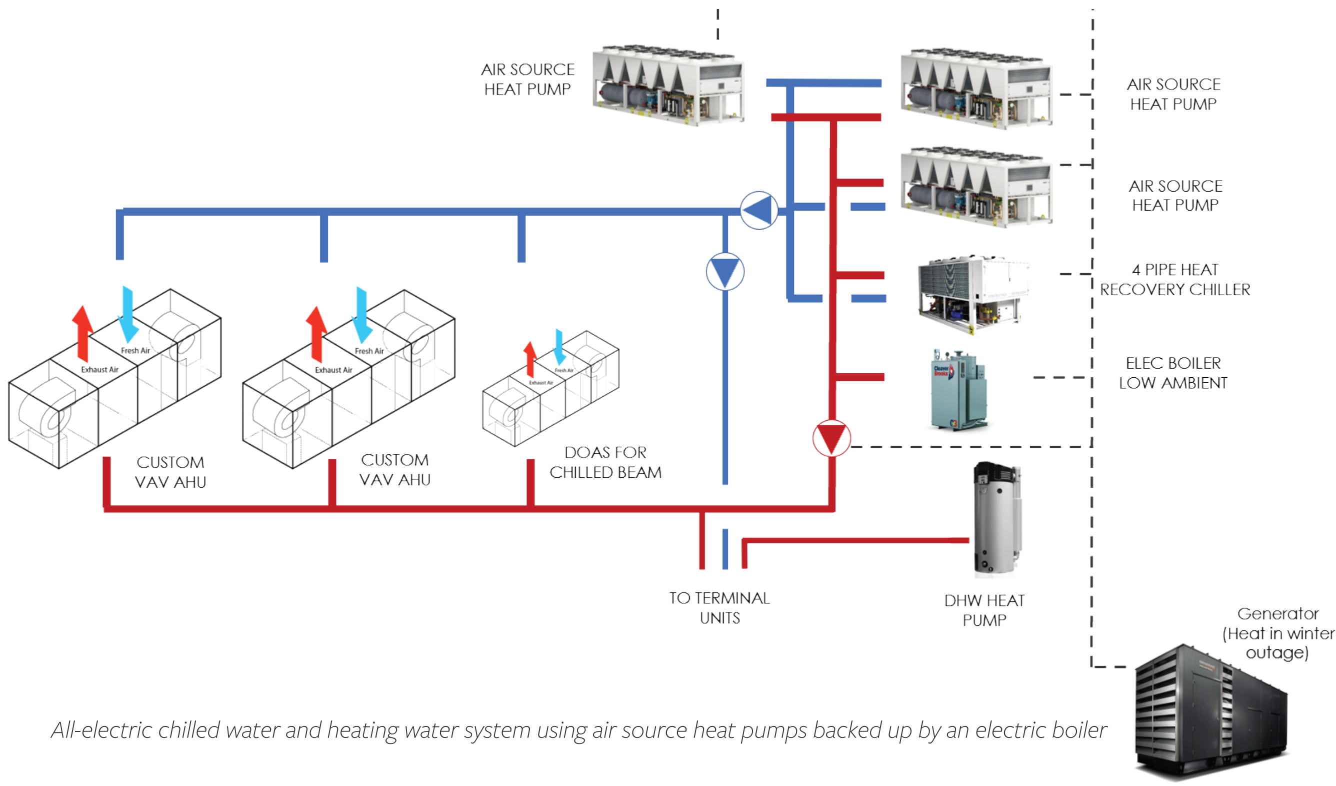
EXISTING BUILDINGS

By retrofitting existing buildings and campuses, you are ready for the grid's eventual electrification—i.e., when the grid stops burning carbon-based fuels and begins providing electricity solely from clean, renewable sources (wind, solar, nuclear).

Using electricity also cuts down on maintenance costs and, depending on your jurisdiction, may save money spent on permits, reduce inspections, and eliminate the need to meet regulations required for equipment running on carbon-based fuels.



Traditional chilled water and heating water system using chillers and gas fired boilers



All-electric chilled water and heating water system using air source heat pumps backed up by an electric boiler

Transitioning to electric systems does come with special considerations, and the process will vary for each building, campus, or central plant-driven district energy system. Your decarbonization strategy should include plans to electrify systems as part of larger master and capital plans, in line with your renewable energy goals. (*Read more about* **specific electrification considerations** *on the IMEG blog.*)

NEW BUILDINGS

If you are building new, electrify proactively. This includes designing for low-temperature heating water, right-sizing incoming electrical service for electrified heating, integrating compressor-based heating sources, and preparing the facility for 100% renewable integration—opening the door for sources like solar panels, wind turbines, etc.

Be micro-grid ready

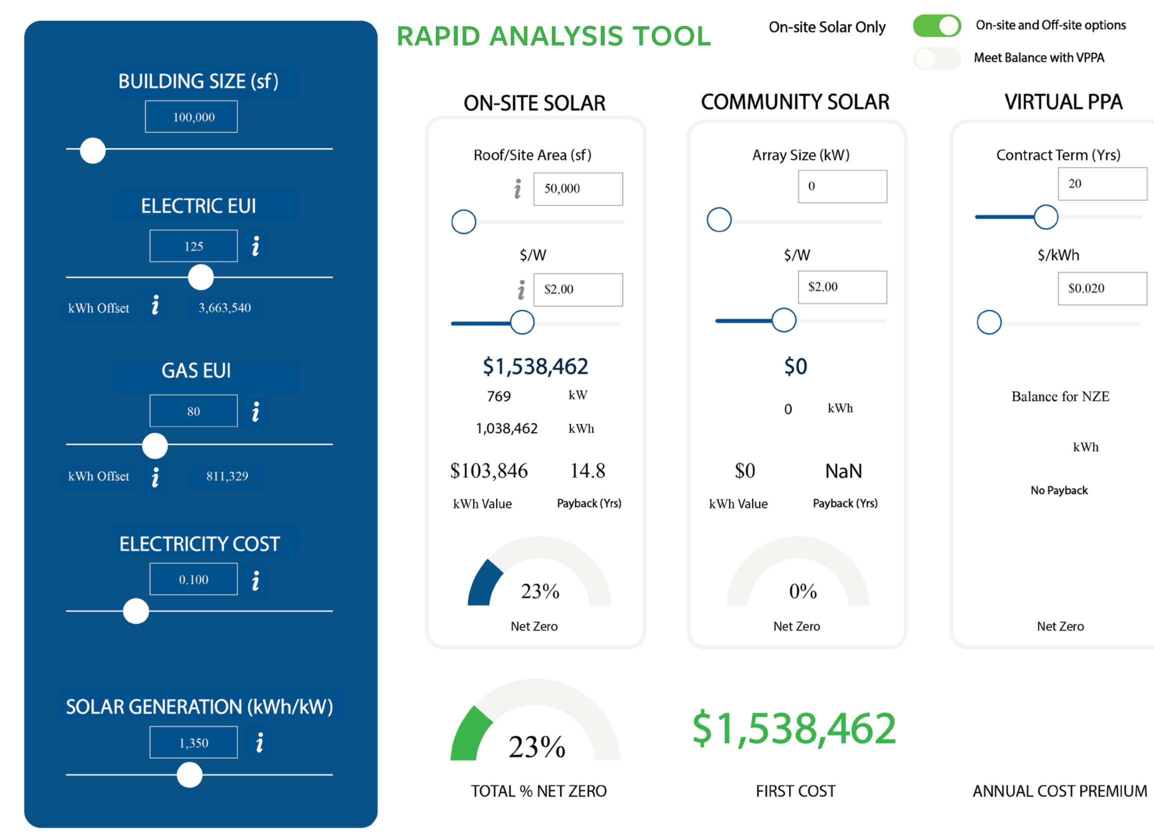
A thermal or electric microgrid is a free-standing power source that operates autonomously from the grid, providing operational resilience. They may consist of a variety of combinations of electricity sources—solar panels, wind turbines, combined heat and power plants, etc. This requires detailed planning at the building and campus-wide levels. Retrofitting existing campuses will involve dedicated projects or capital investments, while new buildings should be designed to be microgrid-ready from the outset.

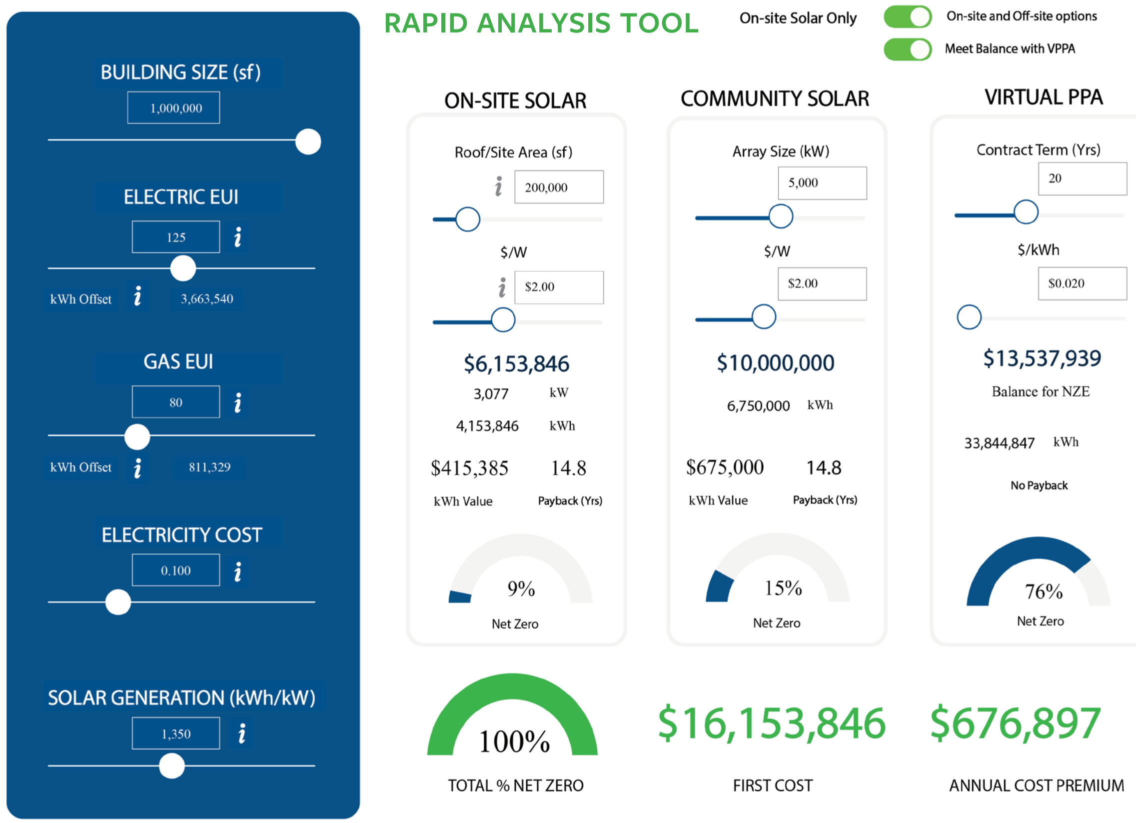
STEP 4: INTEGRATE RENEWABLE ENERGY

Ultimately, all energy used for new or existing buildings should come from renewable sources. This part of a decarbonization plan involves deciding which renewable energy sources you will develop on site and what the utility's greening of the grid will accomplish. Your renewable energy strategy needs to match your electrification strategy.

Many solutions are rising to the top as technology advances, equipment becomes less expensive, and utilities increase demand charges. Over the course of a 30-year plan, you will probably consider solar photovoltaic and battery energy storage at many sites, and wind, hydroelectric, or perhaps even nuclear energy through an off-site plan (usually with a power-purchase agreement). Though highly efficient combined heat and power (CHP) systems do emit carbon, using them in conjunction with fuel cells at large energy-using sites can be considered as a transition strategy toward decarbonization.

Educational leaders should experiment with renewable energy projects to determine the best approach for their organization and investigate funding opportunities. For instance, some campuses start with owner-procured solar panels on roofs or ground on campus or at a remote location to learn more before they move on to a bigger project. (For help with early planning and feasibility of solar PV for a building site, including space and cost requirements, check out IMEG's **Rapid Analysis Tool**, shown below and on the following page.)





Some school districts, colleges, and universities also have found success leasing available space to a third-party renewable energy developer. In this setup, the developer installs, finances, and maintains the renewable energy system, with the owner paying for it gradually through monthly utility bills.

Several programs provide incentives, grants, or tax credits for investments in energy savings or renewable energy technology, which can increase your return on investment. The Inflation Reduction Act of 2022 included $370 billion for clean energy and climate initiatives, the largest-ever investment by the federal government. Additional opportunities are available through the 179D Commercial Buildings Energy-Efficient Tax Deduction and your local utility companies.

By tapping into a variety of these sources, school districts and higher education campuses can achieve significant savings. Furthermore, savings from an initial initiative can be reinvested in a second initiative, and so on.

Funding sources

Construction of net-zero schools and campus buildings can **cost less** than traditional schools. **Utility incentives**, **federal infrastructure funding** opportunities, and private sector financing are available to **finance net-zero schools**. (**Find out what technologies and building types may qualify for incentives on your projects.**)

An opportunity to lead the way

With a growing body of building regulations trending toward reduced emissions, multiple funding sources to draw from, and the existing need to address deferred maintenance and subpar building operations, educational organizations that don't soon begin investing in the decarbonization process may only face higher-cost solutions in the future.

Inaction can be doubly costly. School districts and higher education institutions can pay 20 percent to 25 percent more for increased energy and maintenance costs over the life of unimproved school buildings, leaving less for educational goals. On the other hand, net zero buildings have been shown to use 65 percent to 80 percent less energy, with the remaining energy required coming from renewable sources. Such buildings also require less HVAC maintenance.

To balance budget concerns and decarbonization goals, it's crucial to develop carbon targets and timeline goals, as well as plans, design guidelines, standards, and strategies for major renovations, new buildings, and strategic projects. This planning requires significant effort, coordination, and collaboration, with specific strategies tailored to each

The all-electric Des Moines University Medicine and Health Sciences Campus is modeled to reduce operational carbon by 65 percent.

Supporting sustainable schools

These nonprofit initiatives help educational leadership commit to decarbonization, network, and engage on the topic.

- National School Climate Standards
- USGBC's Leadership in Energy and Environmental Design (LEED)
- Collaborative for High Performance Schools (CHPS)
- Second Nature Climate Leadership Network
- UndauntedK12
- Green Schools Alliance

Initiatives in the architecture/construction/engineering industry also support decarbonization efforts.

- Structural Engineers 2050 Commitment (SE 2050)
- Carbon Leadership Forum MEP 2040 Challenge
- AIA 2030 Commitments

building or campus. Guidance on these and other decarbonization considerations is available from several non-profit and industry organizations. Many completed education projects also provide real-life examples of decarbonization strategies and technologies that have been utilized in a variety of buildings and campuses.

Once you have documented your plan, review and update it quarterly. A living plan puts you in the best position to maximize your return on investment over the next 20 to 30 years. Be sure also to integrate your plan with all relevant initiatives—sustainability, master planning, capital planning, and facility management—so they all work together for the best results.

By their nature, educational institutions have an inherent role to play in the global effort to reduce carbon emissions. Their actions can help educate others, setting a strong example of sustainable and responsible practices for different industries to follow. At a time when students are demanding change and attention to climate issues, educational institutions with decarbonization plans offer teachable moments of ways to "think global, act local."

For a listing of IMEG decarbonization podcasts and decarbonization case studies, refer to the following pages.

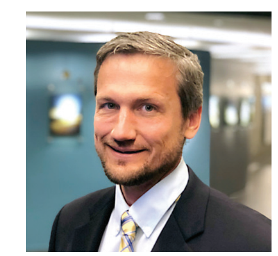
Track your progress

It's crucial to hold quarterly meetings to check on the progress and status of all strategies, goals, and plans involved in your decarbonization efforts. Once monitoring and analytics begin, these sessions usually happen monthly.

Learn more

IMEG offers a full range of decarbonization services to help with the planning, funding, design, and performance optimization of decarbonization projects, be it new construction or a renovation, a single building or an entire campus. To learn more about decarbonization and how IMEG can assist, contact the authors:

John Holbert, PE, LEED AP
Vice President of Education
309-793-3363
john.e.holbert@imegcorp.com



Adam McMillen, PE, LEED AP BD+C
Director of Sustainability
630.753.8544
Adam.M.McMillen@imegcorp.com

Doug Sitton, PE
Client Executive, Building Performance & Analytics
314.309.2029
Doug.D.Sitton@imegcorp.com

Laura Hagan, PE
Senior Sustainability & Energy Engineer
415-836-9318
laura.g.hagan@imegcorp.com

The **Future**.
Built **Smarter**.

Decarbonization podcasts

Learn more about decarbonization on the IMEG podcast.

- Phius leader keen on passive building's role in decarbonization
- How Ann Arbor seeks to lift up an underserved neighborhood through community geothermal
- UW Health bringing a proton center powered by the sun to Madison
- Planning is essential for meeting education market challenges
- Embodied Carbon in the Crosshairs of Designers, Bill Gates, and Girl Scouts
- The Chiller Reality: Your MEP Equipment is Full of Embodied Carbon
- Cold Climate Electrification: A Path Toward 'Clean' Heating
- Call in the Reserves: Thermal Energy Storage to the Rescue
- Battery storage: Clean energy for a rainy day — and peak demand relief
- 5 steps to begin the process of decarbonizing your building

Decarbonization case studies

Prairie Trails School, Mount Prospect, IL: This preschool and kindergarten is the nation's first net-zero energy school that also meets the 2018 PHIUS+ Source Zero project standard. The all-electric school has an operational EUI of 24, saves the district $32,000 a year in energy costs, and has been verified "net positive." It is a 2023 U.S. Department of Education Green Ribbon School and received the U.S. Department of Energy Efficient and Healthy Schools Program Best in Class – Retrofit Revolutionary Award. Read the case study.

SUNY Clean Energy Master Plans: Clean Energy Master Plans (CEMPs) were developed for the State University of New York's Potsdam, Plattsburgh, Canton, and Polytechnic (Utica) campuses. Each CEMP outlines applications of technologies to achieve energy and greenhouse gas emissions reductions and the phase-out of fossil fuel use through electrification—with phased steps to be taken at both the building and the campus levels from now through 2050. Read the case study.

Des Moines University all-electric LEED Silver campus, Des Moines, IA: The all-electric mechanical design for DMU's new west campus features a 700-well geothermal system for heating and cooling of all buildings. The campus is modeled to have an energy use intensity (EUI) of 40 compared to the 90 EUI baseline, a 56% reduction in electric usage, and a 65% reduction in operational carbon. It is powered by over 88% renewable wind and solar energy provided by the utility provider. Read the case study.

Public Schools Bond Measure and Decarbonization, Ann Arbor, MI: As part of a $1B bond measure passed by Ann Arbor Public Schools, IMEG is providing engineering design services for the new Mitchell Elementary School and Pathways High School, both of which will help achieve the district's goals of dramatically reducing embodied and operational carbon as well as energy consumption. Read the case study.

Peter B. Lewis Gateway Center, Oberlin College, OH: This highly sustainable, mixed-use development is the first step in achieving the goals of the Oberlin College's Green Arts District, a 13-acre-block initiative designed to bring the arts and sciences together and create a transformative, 100 percent sustainable area. Read the case study.