DEVELOPER OVERVIEW

High-Performance Buildings Yield Higher Value

High-Performance Building Procurement Toolkit

CONTRIBUTORS & ACKNOWLEDGMENTS

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builtenvironmentplus.org

sustainable-performance.org

masscec.com

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Why Build High Performance?

High-performance (HP) buildings are healthy, durable, long-lasting structures that operate with less energy, use fewer natural resources, and require less maintenance than traditional buildings, and they adapt easily to new uses for the future. Airtight but well-ventilated buildings with highly insulated enclosures are central to the HP concept. They are designed to be comfortable and resilient, even during power outages and despite the impacts expected from a warming climate.

High-performance buildings deliver better value and greater return on every invested dollar by reducing inefficiencies and utilizing smart building practices.

It is often assumed that high-performance projects are more expensive to build. In reality, the majority of HP design strategies rely on best practices like passive design, smart orientation and building system optimization that do not require expensive technology but do fundamentally improve the operating function of the building. Any additional upfront costs are generally offset by long-term operating and energy savings and provide additional sources of value. Note that the high operational and maintenance costs of traditional, less efficient buildings should be quantified in any comparison to the life-cycle costs of high-performance buildings.

BOSTON ARTS ACADEMY. BOSTON, MA.
PHOTO: WILSON BUTLER ARCHITECTS

Benefits of Building to High Performance Standards

1 IMPROVED FINANCIAL PERFORMANCE

- Savings on utility and maintenance expenses
  - Lower energy bills
  - Lower water use
  - Simplified and "right sized" mechanical systems lower capital cost and maintenance
  - Potentially lower insurance premiums
- Increases employee productivity, wellness, and retention
- Increases resale value or rental rates and faster leasing (where applicable)
- Increases funding opportunities: Green building attributes are appealing to lenders and insurers.
- Ability to maintain higher occupancy in pandemic conditions with a focus on healthy indoor air quality
- Significant financial incentives and technical assistance are available at both design and construction phases, depending on location. Contact Mass Save® or the local municipal utility to learn more.

2 ENHANCED PUBLIC PROFILE

- Increased recognition and marketing possibilities
- Higher perception of brand
- Attract and retain talent or top market residential tenants

3 SUPERIOR OCCUPANT EXPERIENCE

- Excellent ventilation and indoor air quality
- Increased thermal comfort
- Reduced noise levels
- Optimized natural lighting

4 INCREASES RESILIENCE AND REDUCES ENVIRONMENTAL IMPACT

- Reduced risk of system failures and disruption of services
- Provides comfortable living conditions for longer during power outages or heating/cooling interruptions (Passive Survivability)
- Durability strengthens resilience to extreme weather
- Reduced energy demand and emissions of greenhouse gases and other pollutants
- Align with local and global decarbonization goals
- Stay ahead of evolving regulations that will require these features in the future

WANT MORE INFORMATION?

Check out the following resources – reports, research, and current articles that support the cost and value of high performance as described above:

- Built Environment Plus: Zero Energy Buildings in Massachusetts
- Built Environment Plus: Massachusetts is Ready for Net Zero
- Institute for Market Transformation: High-Performance Buildings and Property Value
- New York Times: As Risks of Climate Change Rise, Investors Seek Greener Buildings
- STOK: Corporate Real Estate's Role in ESG: Scaling High-Performance Buildings by Leveraging an Effective Real Estate Program
- STOK: The Financial Case for High Performance Buildings: Why it Matters
- Phius: Cost Data

Massachusetts Incentives:

- Mass Save®: New Construction and Major Renovations
- Mass Save®: Passive House Incentives (multifamily)
- Check for other possible incentives with your Municipal Utility

Get Inspired with these examples of passive house buildings:

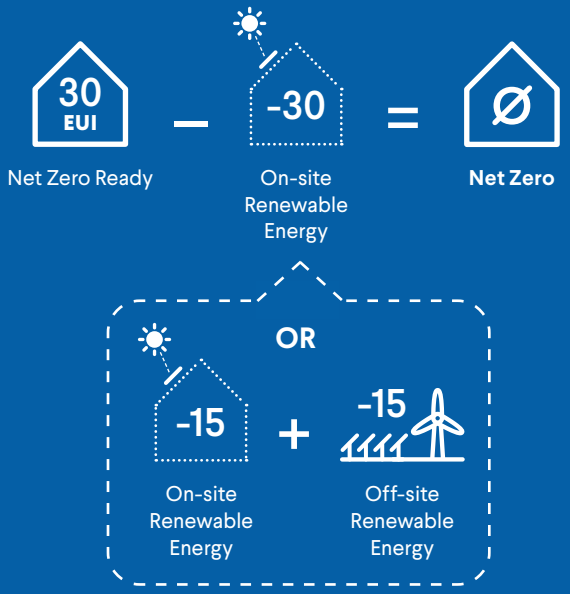
- High Performance Buildings Magazine: Case Studies
- Passive House International: 10 Passive House Buildings that are not houses

How High-Performance is Done

Numerous technical guides illustrate strategies for designing high-performance buildings, but successful outcomes rely as much on the process of design and decision-making as on the strategies that are ultimately chosen. That's why the first step is to select a design team that knows how to design high-performance buildings or at least is highly motivated to learn. This means that they have demonstrated experience achieving client goals and understands that a high-performance building can only be achieved through a highly collaborative process.

Even if you hire the best team, that team still needs you to set clear and ambitious goals. It is important to request a Net Zero option early on to assess what commitments can be made and what it would take to achieve the best value. From the outset, make sure that you or your design team engages Mass Save® or the municipal utility to take advantage of financial incentives and/or technical assistance that support both design and construction.

BOSTON UNIVERSITY, CENTER FOR COMPUTING & DATA SCIENCES - THE LARGEST NET ZERO ENERGY BUILDING IN BOSTON . PHOTO: TOM ARBAN



A Net Zero building generates as much energy as it consumes on an annual basis.

To achieve zero energy a project first reduces energy use through efficiency measures and optimizes for renewables. Once Net Zero energy ready, the project requires renewable energy on-site and/or off-site to offset the remaining energy use.

Essentials of a High-Performance Building

SITE AND CONFIGURE THE BUILDING TO MINIMIZE ENERGY LOADS

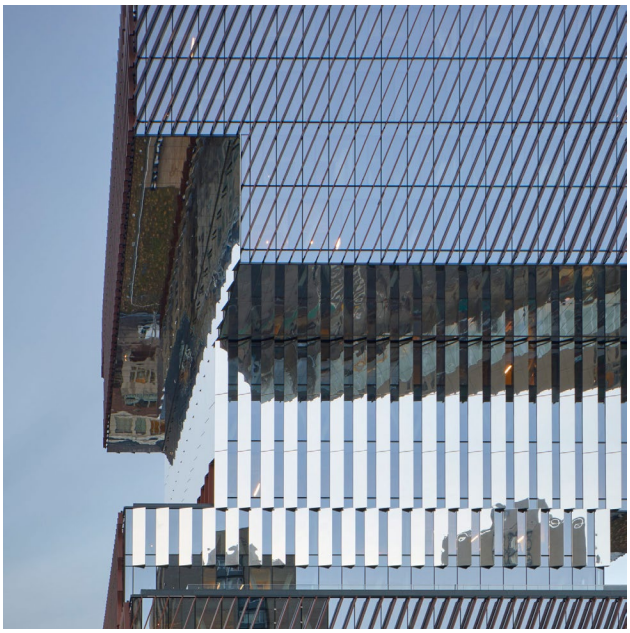
Take advantage of free energy! Siting, massing, and solar orientation will greatly influence energy use. This is called passive solar design. These strategies don't add cost, but they do save money! Taking advantage of free natural resources like light, heat, and natural ventilation means that mechanical systems will do less of the heavy lifting. The following strategies are often overlooked:

- Optimize glazing on southern elevations plus appropriate shading on these areas in summer.
- Limit north, east, and west windows to prevent heat loss and too much solar gain.
- Optimize natural lighting by separating view glass that is properly recessed or shaded from ambient light. Glass should be at the clerestory level where possible.

ANNIE E. FALES ELEMENTARY SCHOOL - THE FIRST NET-POSITIVE ENERGY PUBLIC SCHOOL IN NEW ENGLAND. WESTBOROUGH, MA. PHOTO: HMFH ARCHITECTS

PRIORITIZE BUILDING ENVELOPE

A building's envelope is typically its most durable feature. Unlike mechanical systems, which require periodic replacement, most aspects of the envelope will remain unchanged for many decades. Therefore, investment in a high-quality enclosure will continue to provide better value over time. Further savings are achieved when envelope, mechanical, and lighting strategies are considered together, which can avoid oversized or redundant equipment. For example, well-insulated walls with highly insulated glass can eliminate the need for perimeter heating systems. Highly collaborative teams will analyze these trade-offs and their long-term costs to strike the best balance.



BOSTON UNIVERSITY, CENTER FOR COMPUTING & DATA SCIENCES - "TRIPLE-GLAZED CURTAIN WALL WITH FIXED EXTERIOR SHADES ELIMINATE THE NEED FOR PERIMETER HEAT AND REDUCE COOLING LOADS." - BR+A CONSULTING ENGINEERS. BOSTON, MA. PHOTO: TOM ARBAN

CONSTRUCT TO BE BEST-IN-CLASS

- Design according to climate zone and projected temperatures (not historical).
- Carefully assess the best insulation for the entire six-sided envelope (walls, roof, and foundation) to match Passive House standards per climate zone. As Passive House envelope standards are increasingly required in municipalities, you will be ready for regulatory requirements!
- Select triple-paned windows in wood or fiberglass frames.
- Prevent typical heat loss through the enclosure by using continuous insulation and an airtight barrier. Then conduct blower door testing where appropriate and envelope commissioning to make sure installations were done well and to catch any areas with breaches.
- Design a solar-ready building wherever there is viable solar exposure. Carefully consider the locations of roof penetrations to minimize interference with solar PV panels. Once those penetrations are set, they are impossible to change and can reduce solar generation potential by 30% or more! Whether solar panels are installed immediately or at some point in the future, ensure your building is solar ready!

FINCH CAMBRIDGE - THE FIRST AFFORDABLE PASSIVE HOUSE BUILDING IN MASSACHUSETTS. CAMBRIDGE, MA. PHOTO: ROBERT UMENHOFER

Passive House is a performance-based building certification that focuses on the dramatic reduction of energy use for space heating and cooling.

It is based on clearly defined metrics for energy performance that can be achieved through high-quality design and construction techniques.

HEATING, VENTILATION AND COOLING

- During the programming phase, consider space adjacencies that group highest energy intensive spaces near each other, when possible, for greatest efficiency.
- Provide a central natural air ventilation system that captures and reuses indoor energy, such as an energy/heat recovery ventilator (ERV or HRV)
- Do not oversize the mechanical system!

  - With a well-insulated envelope, the mechanical system needed is smaller– it will be less costly to purchase and operate.

  - Invest in energy modeling to anticipate true load (utility or municipal incentives can help).

- Use all-electric systems. Emissions associated with electricity from the grid are already lower than what on-site fossil fuel combustion would produce. Over time, grid electricity is getting cleaner.

  - Heat pumps (air or ground source) provide highly efficient, highly customizable solutions for heating, cooling, and domestic hot water needs.

  - Consider solar thermal for hot water heating.

CONCORD RIVERWALK - WITH VERY TIGHT BUILDING ENVELOPES, EACH COTTAGE ONLY USES AS MUCH ENERGY AS CAN BE PROVIDED BY ON-SITE SOLAR. PHOTO: UNION STUDIO ARCHITECTURE

BELMONT MIDDLE & HIGH SCHOOL - 100% ELECTRIC WITH A GEOTHERMAL WELL HEAT PUMP SYSTEM TO PROVIDE HEATING AND COOLING TO THE BUILDING. BELMONT, MA. PHOTO: PERKINS+WILL

ENERGY- AND WATER-EFFICIENT APPLIANCES AND FIXTURES

- Install LED and low-energy-use light fixtures
- Select appliances with Energy Star ratings
- Specify all plumbing fixtures with EPA Water Sense compliance
- Induction cooktops and ranges are catching on for both commercial kitchens and residences!

POWISSET NET POSITIVE BARN - APPLIANCES AND HIGH EFFICACY LED LIGHTING ENSURE EFFICIENT ENERGY CONSUMPTION. DOVER, MA. PHOTO: ERIC ROTH

THEN.... BE READY FOR RENEWABLE INFRASTRUCTURE.

Renewables come last. Once you've done the basics to reduce your energy demand and create the best insulated building possible, you are able to make the best economical use of renewable energy.

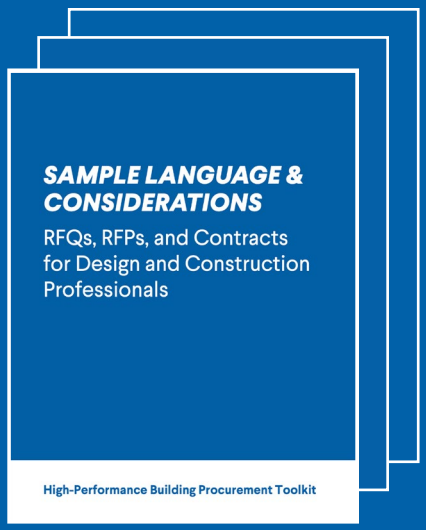
- Install solar panels on site or construct buildings to be "solar-ready"
- Provide EV charging stations or plan for future charging infrastructure
- Depending on the type of project, install (or be ready for) battery storage for resiliency or peak-shaving purposes

R.W. KERN CENTER- THE LARGEST LIVING CERTIFIED HIGHER-EDUCATION PROJECT IN THE WORLD AT THE TIME OF ITS COMPLETION. AMHERST, MA. PHOTO: BRUNER/COTT ARCHITECTS

CHECK OUT THESE RESOURCES FOR HELP!

Hire the best teams:

- BE+ CONNECTS - Find High Performance Pros with proven experience
- BE+ MassCEC: Additional High-Performance Building Procurement Toolkit documents



One-stop resource for all aspects of HP building:

- Whole Building Design Guide (WBDG)

Targeted resources:

- Williams College: Passive Solar Design
- Phius: Passive Building Principles
- Whole Building Design Guide (WBDG): High Performance HVAC
- RMI: Clean Energy 101: Heat Pumps
- MassCEC: Air-Source Heat Pumps

Incentives and Rebates:

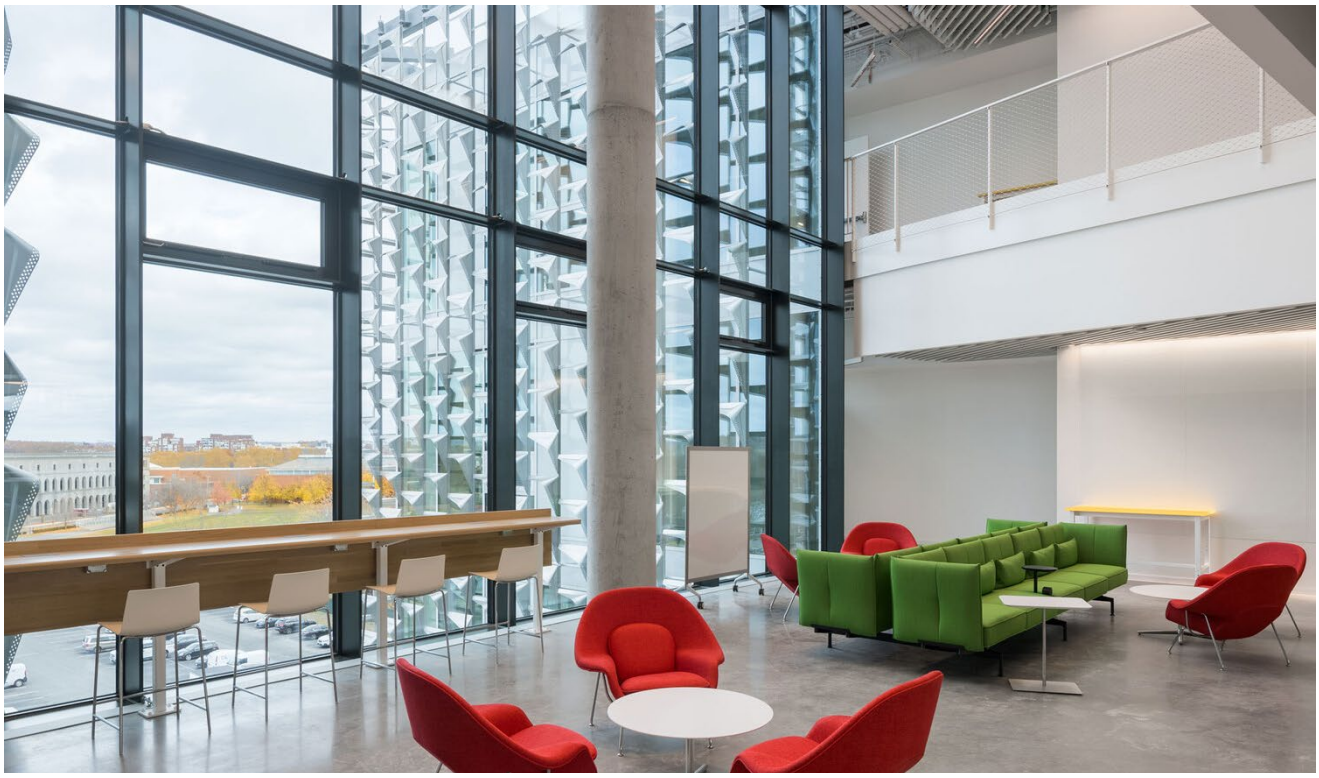
- Mass Save®: New Construction & Major Renovations

Going Beyond Energy

UMASS CROTTY HALL - THE CAMPUS'S FIRST NET-ZERO BUILDING, CLEANS AND INFILTRATES STORMWATER MAKING IT ONE OF THEIR GREENEST BUILDINGS. AMHERST, MA. PHOTO: STIMSON LANDSCAPE ARCHITECTS

Building projects provide opportunities to enhance communities and occupant health beyond the critical issues of energy and carbon. Other beneficial areas are exterior site and landscape and interior, building materials, and supply chain. These provide further opportunities to enhance the value of your assets, making them even more attractive to prospective tenants or owners.

- Low-impact development (LID) can reduce both up-front and maintenance expense for the site and its landscaping, while providing benefits to ecosystems, such as, collecting and storing rainfall for irrigation. Green infrastructure elements such as these decrease demands on over-taxed stormwater systems:
  - Green roofs
  - Rain gardens
  - Bio-retention areas
  - Permeable paving



HARVARD UNIVERSITY SCIENCE AND ENGINEERING COMPLEX - NAMED ONE OF THE HEALTHIEST, MOST SUSTAINABLE, AND ENERGY-EFFICIENT LABORATORY BUILDINGS IN THE WORLD. ALLSTON, MA.
PHOTO: BRAD FEINKNOPF

- Pay attention to your material choices to create healthy interiors, lessen waste, and reduce embodied carbon.
  - We spend 90% of our time indoors. Specify healthy materials with no/low-VOC (volatile organic compounds) levels and avoid "red-list" materials for better indoor air quality and human health
  - Select materials with low embodied carbon
  - Whenever possible, source materials that are available at shorter distances to the project site to reduce transportation impacts.
  - Investigate waste savings measures such as prefabricated and panelized construction, recycling, and construction material exchanges, including the local BE-Xchange.

UP NEXT

Find more High-Performance Building Procurement Toolkit documents at builtenvironmentplus.org/hptoolkit