tech primer

Wall Insulation

High performance insulation improves comfort and saves energy while reducing utility bills and long-term maintenance costs.

tech overview

applicable building types
all buildings

implementation
at mid-cycle or refinance

fast facts
- increases GHG savings
- improves acoustics
- improves comfort
- reduces heat and cooling loss
- enhances building performance

costs & benefits*

GHG Savings

Tenant Experience Improvements

Utility Savings

Capital Costs

Maintenance Requirements

*ratings are based on system end use, see back cover for details.

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getting to know wall insulation

Insulation, in tandem with other enclosure elements, plays a critical role in moderating indoor comfort. Optimizing the type, amount, and location of insulation can hugely improve comfort and lower utility bills.

why upgrade wall insulation?

For older buildings, and for new buildings targeting high performance, careful upgrading of insulation is among the most effective means of reducing energy use and improving interior comfort. When upgrading existing buildings, insulation can be applied to the interior or, as preferred, the exterior. Coupled with high performance windows and proper air sealing, insulation upgrades can, in some cases, eliminate the need for perimeter heating.

The envelope of a building keeps the outside outside — controlling the transmission of heat, air, water vapor, and moisture. All of these factors are managed by a series of control layers, including insulation, which must be correctly installed and coordinated in order to successfully create a protective enclosure. Each control layer interacts with, and influences, the others. Improper design or installation of control layers can result in the uncontrolled intrusion of water, air and vapor, leading to occupant discomfort, high energy bills and even structural damage.

Assess
Always consult a qualified service provider before undertaking any building upgrades.

Coordinate Upgrades for Maximum Savings
Optimize upgrades to wall insulation by ensuring airtightness and vapor control layers are correctly specified and insulated.

To maintain comfortable and efficient indoor space temperatures, optimize all the “control layers” in the wall assembly.

Plan Ahead for Success
The best time to implement wall insulation upgrades is during refinancing or when other envelope improvements are scheduled (often triggered by Local Law 11 compliance). Insulation upgrades should be considered during scheduled window replacement or air-sealing upgrades to save cost and reduce disruption to residents.
how to upgrade wall insulation

Upgrading wall insulation in conjunction with air sealing and the installation of high performance windows and doors completes a whole building envelope retrofit that will greatly enhance building performance.

Applying insulation to the exterior is always preferred. But other factors—including historic preservation restrictions, costs, zoning requirements, space restrictions, and aesthetics—may dictate that an interior application be considered. The target for insulation performance should be based on long-term planning of all building systems, not just meeting current code. In any case, designers should use WUFI or other software to analyze the movement of heat and moisture through the assembly, and carefully analyze any thermal bridging conditions.

1. **Rainscreen Systems**
   - Rainscreens include a grid-like frame attached to the façade, with control layers installed between and beneath this framework. Exterior panels are attached to the framework.
   - The control layers are typically separate
   - They can either replace or cover existing exterior finishes (bricks, panels, etc.)
   - Points of attachment should be carefully designed to limit thermal bridging

2. **Exterior Insulation and Finish System (EIFS)**
   - Incorporates all control layers into one system
   - Install options: Either adhere directly to existing brick, or, if brick is not sound enough, mechanically fasten exterior sheathing to brick, then adhere system to sheathing
   - Adhesive acts as air barrier
   - Pay special attention to proper drainage, as standing moisture within EIFS can cause significant damage.

![EIFS diagram](image)

**Fig 1.** EIFS typically contain a layer of sheathing fastened to the existing brick or other cladding material, with the insulation adhered directly to the sheathing.

Interior Insulation—Adding insulation to interior walls preserves the aesthetic of the exterior but carries risks due to moisture intrusion and freeze/thaw cycles.

1. **Analyze Conditions**
   - Prior to insulating, confirm wall is not exposed to excessive water and carefully analyze moisture and freeze/thaw cycle impacts on assembly to determine location and type of vapor control layer(s).
   - Apply form fitting insulation such as batts at interior face of exterior wall, typically with inboard air barrier.
   - Walls and floors that meet the exterior walls represent thermal bridges; determine mitigation measures, if any.

2. **Install Insulation System**
   - If insulating between studs, provide a continuous layer over or behind studs to mitigate thermal bridges
   - Stagger and tape all joints
   - Use loose fill to close gaps or cavities (Avoid high toxicity products like spray foams)
   - Carefully seal around all wall penetrations (most especially joists)
**Greenhouse Gas (GHG) Savings**

A moderate reduction in heating and cooling related GHG emissions can be expected from a wall insulation upgrade, depending on the existing condition of the building envelope and the current heating and cooling demand. Air sealing is critical to realizing these reductions, and are multiplied if window improvements are also undertaken.

**Tenant Experience Improvements**

Wall insulation upgrades, when combined with comprehensive air sealing, will significantly improve resident comfort by eliminating drafts, improving temperature distribution, and reducing pollution and noise infiltration.

**Utility Savings**

A moderate amount of utility savings can be achieved through the reduction of heating and cooling loads inherent in improving building envelope performance.

**Capital Costs**

Wall insulation upgrades require a large capital investment, and are best implemented when other repair work is scheduled, such as repairs precipitated by Local Law 11 compliance.

**Maintenance Requirements**

Properly designed and installed exterior insulation systems (EIFS, rainscreen, etc.) should require little maintenance. If insulation is applied to the interior of brick facades, regular re-pointing is critical to minimize rain water penetration and freeze-thaw damage. Regular inspection and cleaning of weep holes is critical to ensuring proper water drainage.

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*The Costs & Benefits rating system is based on a qualitative 1 to 4 scale where 1 (GGGG) is lowest and 4 (GGGG) is highest. Green correlates to savings and improvements, orange correlates to costs and requirements. Ratings are determined by industry experts and calculated relative to the system end use, not the whole building.

Note: GHG and utility savings are dependent on existing wall conditions and are based on heating and cooling loads. Assumes existing walls have minimal insulation with no consistent air barrier.

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**Take Action**

This document is one of more than a dozen High Performance Technology Primers prepared by Building Energy Exchange and the Retrofit Accelerator to introduce decision-makers to solutions that can help them save energy and improve comfort in their buildings. Access the complete library of Tech Primers here: be-exchange.org/tech-primers

The NYC Retrofit Accelerator's team of Efficiency Advisors offers free, personalized advisory services to help streamline the process of making energy efficiency improvements to your building. The High Performance Retrofit Track (HPRT) of the Retrofit Accelerator can help you design and implement a 10–15 year capital plan to reduce your building's energy use by 40–60%.

HPRT participants commit to accomplishing deep energy reductions by holistically upgrading all major building systems, including the heating system, cooling system, and the building envelope.

Get in touch with the NYC Retrofit Accelerator today!

Call (212) 656-9202
Visit nyc.gov/RetrofitAccelerator

The Building Energy Exchange (BE-Ex) is a center of excellence dedicated to reducing the effects of climate change by improving the built environment. BE-Ex accelerates the transition to healthy, comfortable, and energy efficient buildings by serving as a resource and trusted expert to the building industry.

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