Durable & Resilient Retrofits –

Solving with stone wool insulation

ROCKWOOL

AIA Continuing Education Provider

Program Registration

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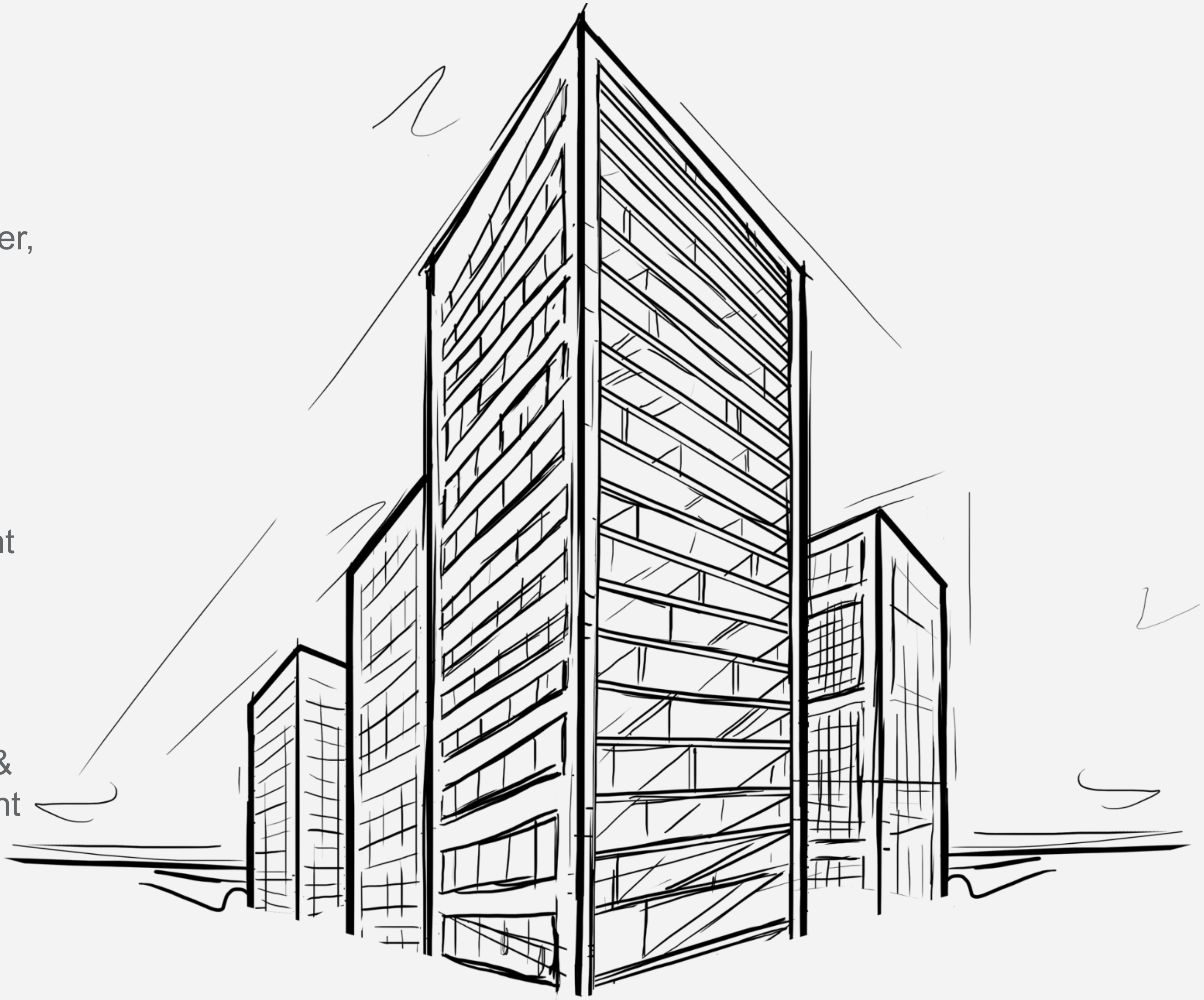
Course Outline

Globally, existing buildings account for approximately 30% of final energy demand and CO_2 emissions. Typical renovation rates are 1-2% of the building stock per year, with an average energy use intensity (EUI) reduction of less than 15%. However, to reach sustainable development and climate targets, EUI reductions should be between 30-50%.

In addition to energy and emissions conservations, building retrofits improve occupant health and comfort. In many cases, existing buildings are poorly insulated and leaky, resulting in excess heat loss and reduced thermal comfort. Mechanical systems are often outdated and inefficient, requiring consistent maintenance. With spending most of our time indoors, indoor health and comfort can be a priceless attribute that can be crucial for building renewal investment.

This course will review core concepts to consider when implementing energy conservation measures through retrofit & renovation. Three unique case studies are provided to highlight the complexity of renovations and look at the ever-present challenges of extreme weather events.



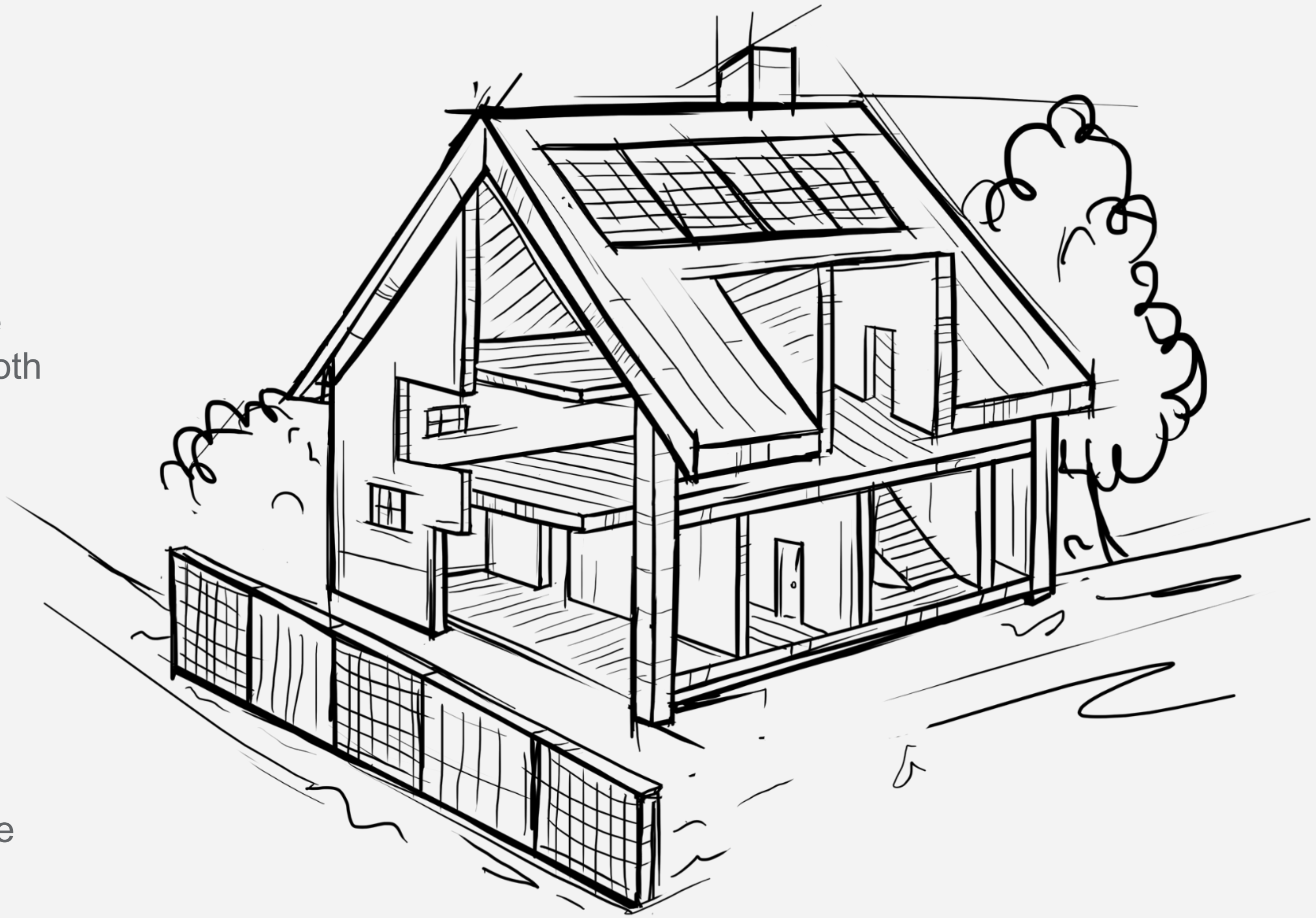
Learning Objectives

1 **Why retrofit?** – Recognizing where retrofit and renovation fits in a building's energy conservation strategy and more broadly explain why retrofitting existing building stock contributes to GHG emission targets.

2 **Retrofitting for enclosure** durability – Retrofits demand unique strategies for both interior and exterior projects. We will explore design considerations that must be made for both applications, focusing on moisture, drainage, and drying.

3 **Stone wool retrofit solutions** – 3 case studies focused on three unique retrofit solutions; highlight critical design considerations that were made, how those criticalities were managed and the resulting assembly design.

4 **Considerations for survivability** – this section seeks to understand ways to manage increasingly prevalent extreme weather events – offering course takers critical design considerations needed when designing for survival and comfort during these events.



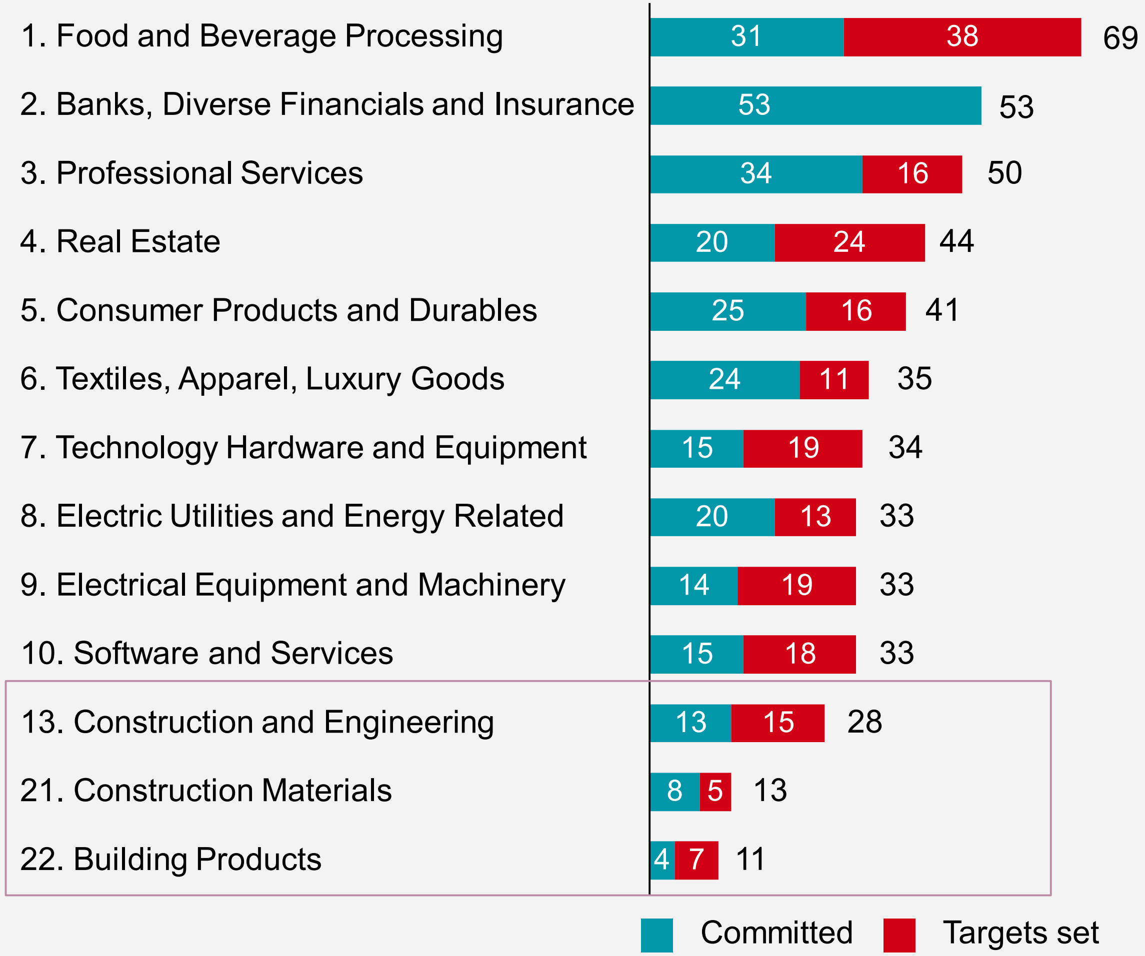
Less than 15 percent of the companies that have committed to setting science-based targets are energy intensive.

Over **1,000 companies** have made a commitment to setting SBTs.

Approx. **500 companies** have approved SBTs.

Many of these companies such as financials and real estate are **low energy-intensive.**

Top 10 sectors with most targets and commitments, plus construction-related sectors, 2015 to 2019



Mineral fiber, mineral wool, stone wool, slag wool – **What's the difference?**

Mineral fiber – A generic term for fibrous inorganic substances.
These can be classified in 3 groups:

Fiberglass

A material consisting of glass fibers used in making various products, including yarns, fabrics, insulation, and structural objects or parts.

Mineral wool*

Stone Wool:
fibrous insulation made by melting predominantly rock

Slag Wool:
Man-made material made primarily from iron ore blast furnace slag.

Refractory ceramic fibers

Man-made fibers produced from the melting of calcined kaolin clay, or a combination of alumina and silica.

*** Note: Glass fiber is commonly included in the mineral wool category outside of the USA**

How it’s made:

Manufacturing of Stone Wool

Raw materials

Basalt Rock
One of the most abundant resources on the planet

Steel Slag
A by-product of the steel manufacturing process

Melted at high temperatures
In excess of 2500°F

Melt is spun into fibers
Using both air and mechanical spinning wheels

Fibers are collected and formed into batts and boards.

Infinitely recyclable
Off-cuts, material from construction sites can be melted into new stone wool without any loss of performance.

Versatility no matter the density

Stone wool insulation can be either flexible or rigid, and deliver a full range of density solutions to meet your needs .

Other mineral fibers
Key markets: Flexible products
Applications: Residential and interior (attics, lofts, partition walls, etc.)

Foam plastics
Key markets: Rigid products
Applications: Building envelope (flat roof, façade, foundation, sandwich wall panels, etc.)

1.5 lb/ft^3
25 kg/m^3

Stone wool
Key markets: Flexible and rigid products
Applications: Interior & exterior walls, roofs, and foundations

12.5 lb/ft^3
220 kg/m^3

The 7 Strengths of Stone wool Insulation

Fire resilience
Withstand temperatures above 2150°F.

Circularity
Reusable and recyclable material.

Thermal properties
Saving energy by maintaining optimum indoor temperature and climate.

Water properties
Manage our most precious resource.

Acoustic capabilities
Block, absorb or enhance sounds.

Aesthetics
Match performance with aesthetics.

Robustness
Increased performance and greater stability with lower costs.

Fire Resilience

NONCOMBUSTIBLE CONSTRUCTION

Buildings with peace of mind built in

Stone wool products can make the difference between a fire in a building and a building on fire.

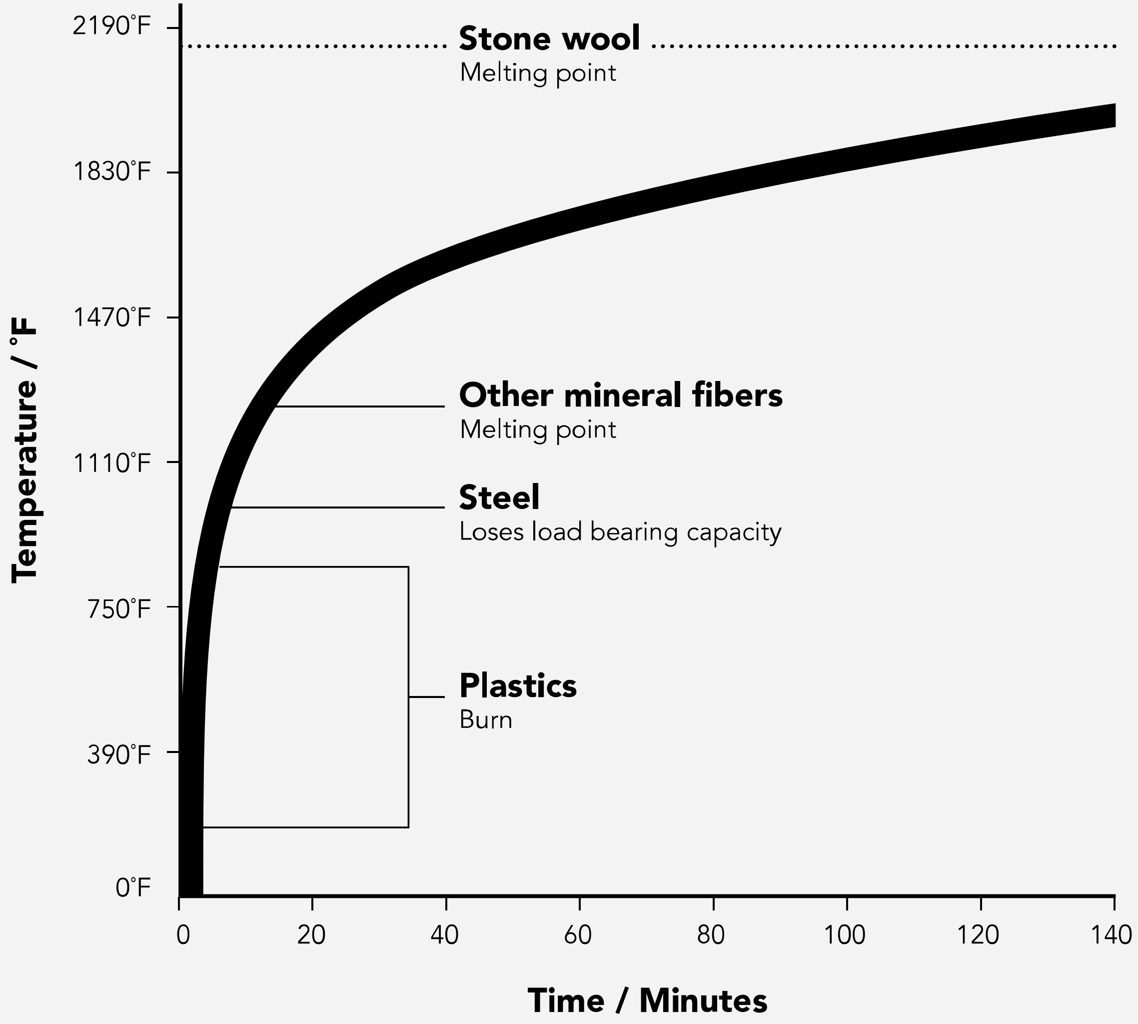
– Stone wool insulation is extremely resilient to fire.

– Stone wool remains stable – even at extremely high temperatures (above 1000º C / 2100º F).

– It works to contain fire and prevent it spreading.

– Does not contribute to the emission of toxic smoke

– Tested solutions for a variety of fire rated applications



Water Repellency

SIMPLICITY AND RESILIENCY

Creating living spaces for today and tomorrow

Stone wool products are engineered to repel water and to allow the wall assembly to dry out.

- Designed to withstand exposure to the elements during construction
- Material has ability to dry out and maintain performance.
- Each fiber is engineered and treated to repel water before becoming a batt or board.

Why retrofit?

> “Climate change is happening right now and it is having a negative impact on people.”

Franz Hartman, Toronto Environmental Alliance
Building Resilience and Cutting Emissions, Climate Atlas of Canada

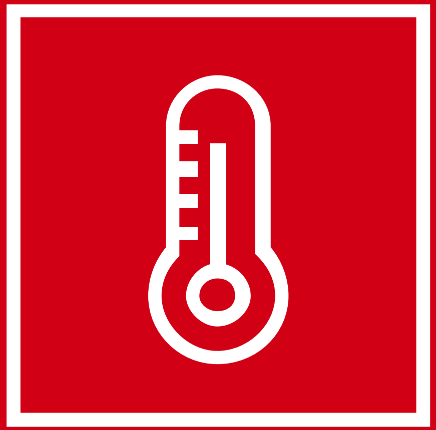
40%
Buildings generate nearly 40% of annual global greenhouse gas (GHG) emissions.

30%
Buildings account for over 30% of the energy used globally.

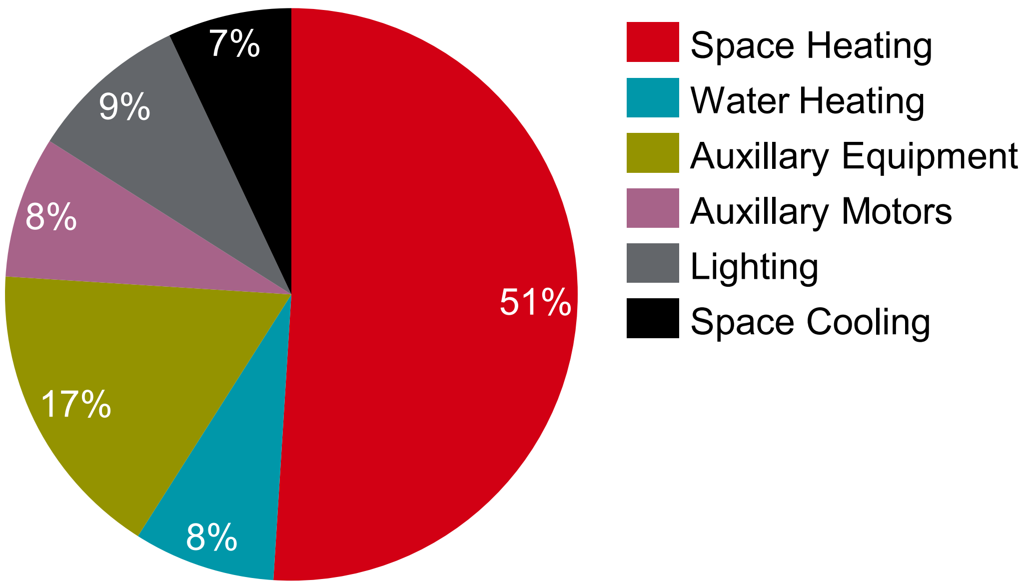
50%
If no action is taken, energy consumption is expected to rise by 50% by 2050.

<2%
Typical renovation rates are 1-2% of the building stock per year globally.

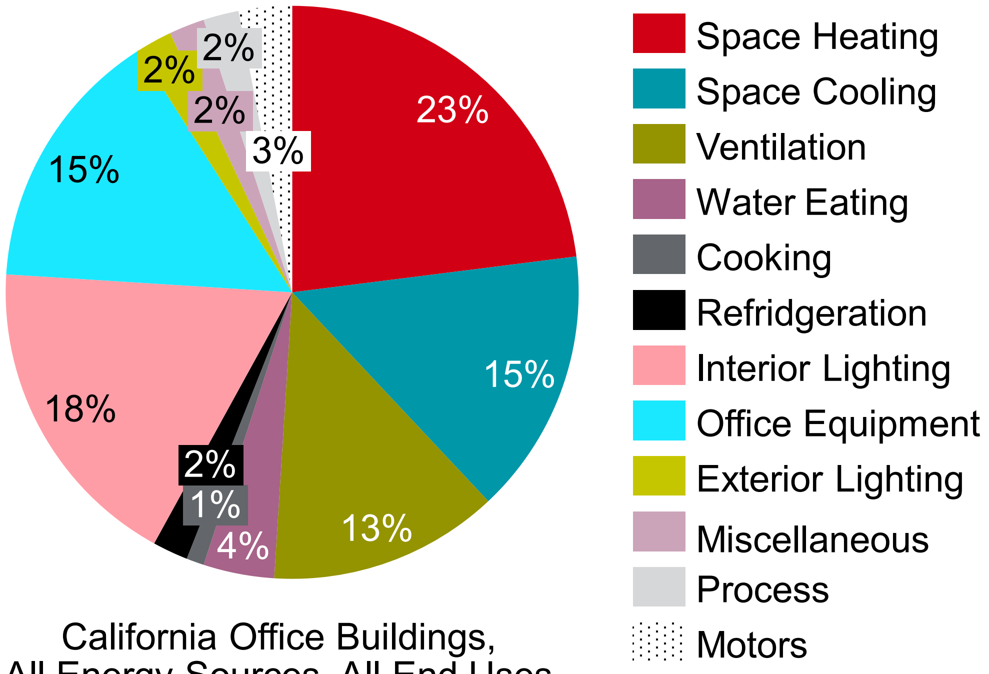
In all climates, the building enclosure has a major impact on the total energy use of the building.



Climate Affects How We Use Energy

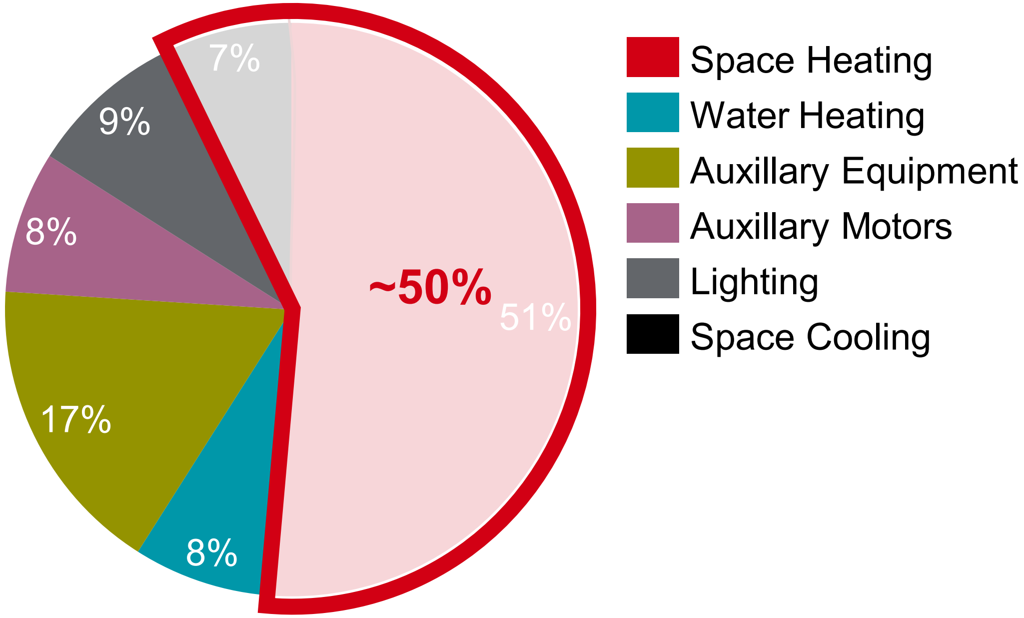


Canadian Office Buildings,
All Energy Sources, All End Uses
(NRCan 2007)



California Office Buildings,
All Energy Sources, All End Uses
(CEC 2006)

Enclosures Affect ~50% of Energy Usage



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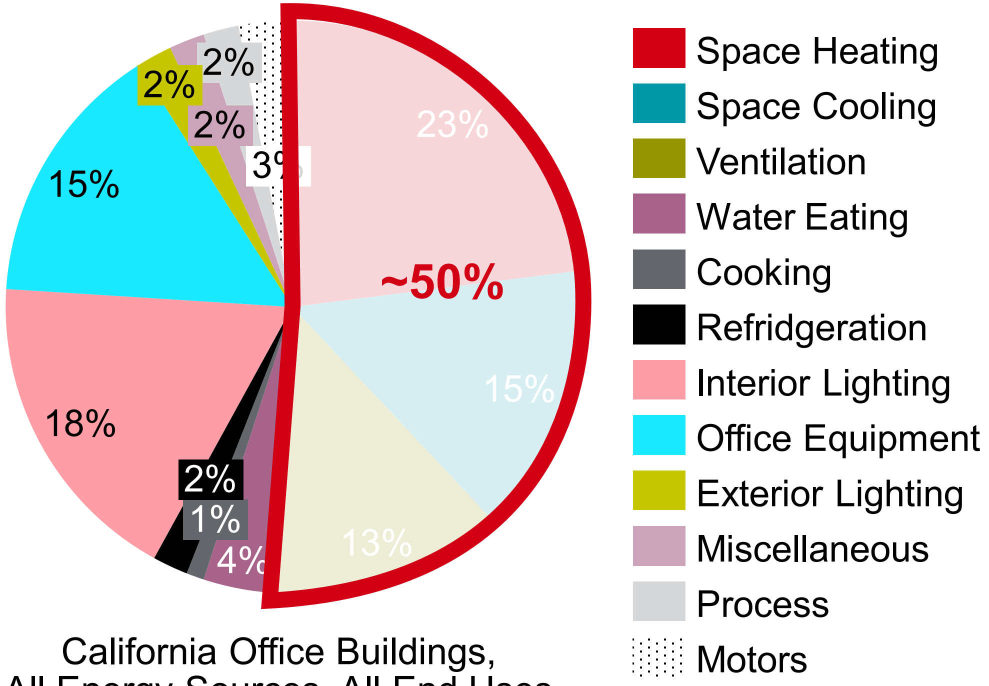
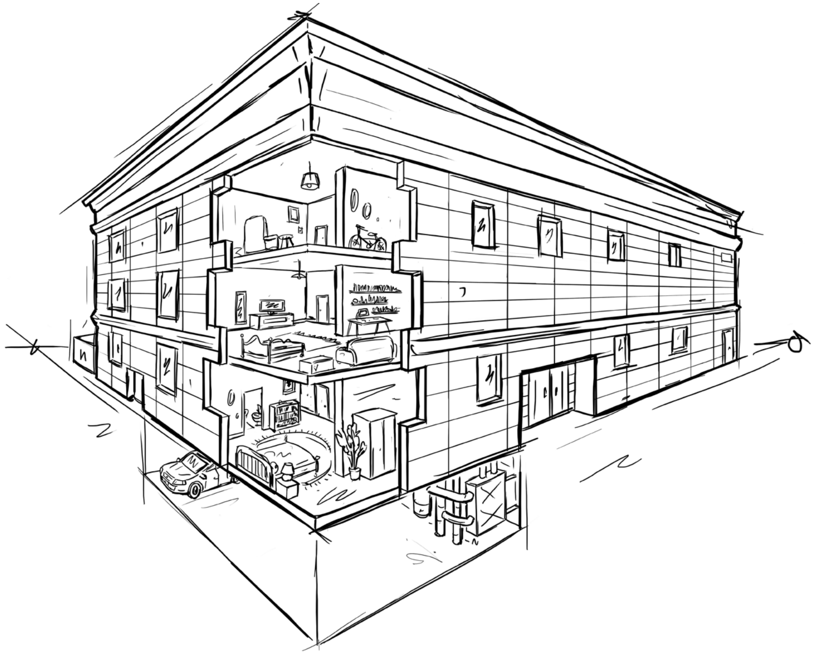


California Office Buildings,
All Energy Sources, All End Uses
(CEC 2006)

Retrofit strategies:

Minor retrofits: low cost, easy to implement

- Sealing with caulking or spray foam
- Upgrading lighting systems



Major retrofits: holistic approach, higher cost with minimal occupant disruption

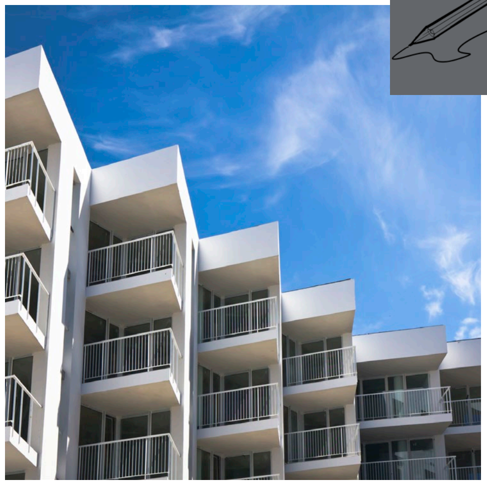
- Adding insulation
- Replacing window glazing and doors
- Updating inefficient heating and cooling systems
- Installing low-flow faucets with sensors and automatic shut-offs
- Installing sub-metering

Deep retrofits: holistic approach, high cost and overhaul of building

- Significantly reconfiguring the interior
- Envelope enhancement – walls, roof replacements, adding or rearranging windows for increased daylight
- Replacing the heating, ventilation and air-conditioning system with a renewable technology like a ground-source heat pump

Key envelope retrofit performance indicators

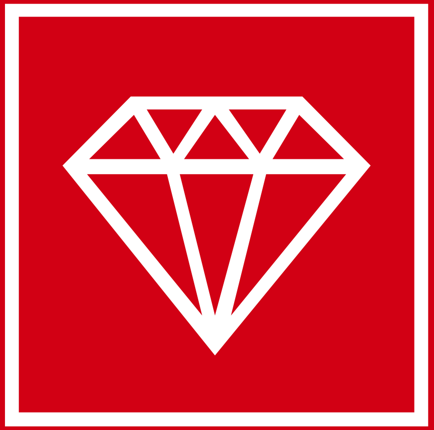
- **Energy use and operational carbon reductions**
- Minimized **embodied carbon** emissions
- Enhancement of **thermal resiliency**
- Improved enclosure **durability**
- Improved **occupant comfort**



One-size does not fit all – Methods that are selected for a building retrofit will vary by project.

Retrofitting for enclosure durability

Durability is not an intrinsic property of a material, but rather a function of the material and its environment.



CONTROL LAYERS

Building Enclosure Control Functions

Rain/water Control ▶ Drainage plane & gap and/or waterproofing

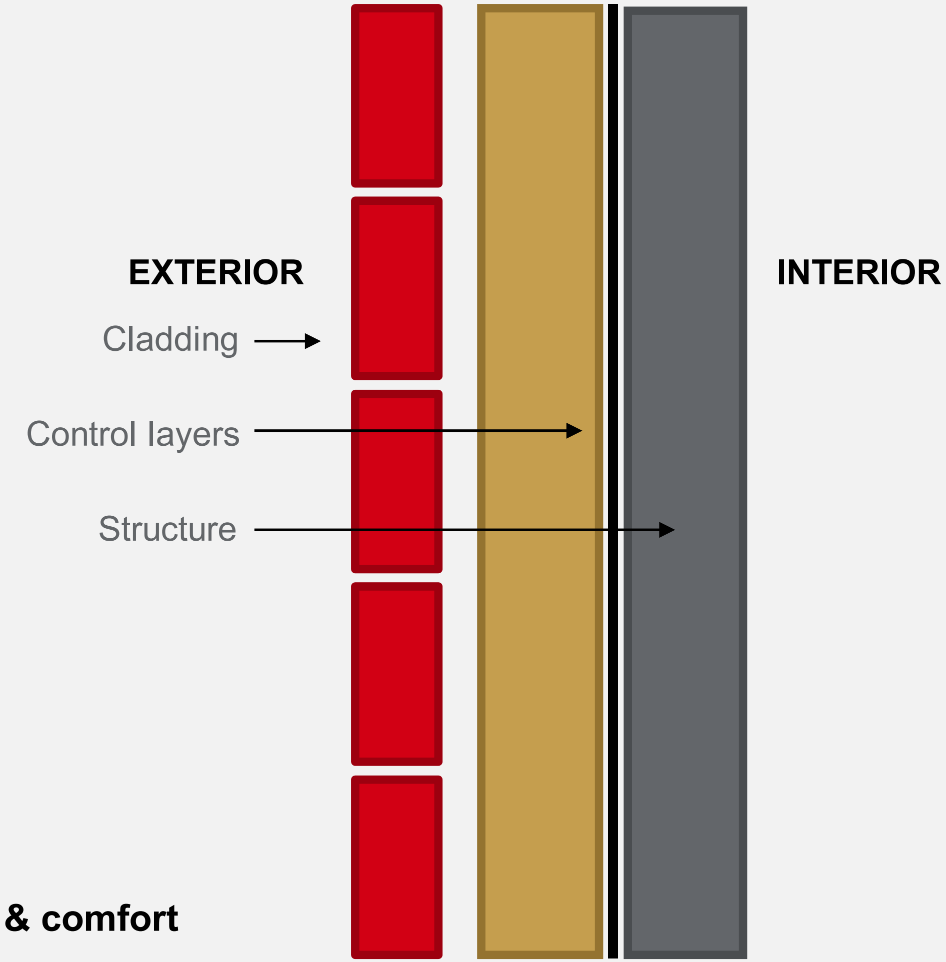
Air Control ▶ Air barrier system

Thermal Control ▶ insulation

Vapour Control ▶ vapor retarder/barrier as required

Fire & smoke ▶ firestopping and fire-rated assemblies as required

Sound ▶ OITC/STC/ASTC rated assemblies, fenestration



The goal is to find a balance between:
Energy savings ◀ ▶ Durability & Resilient enclosure ◀ ▶ Occupant health & comfort

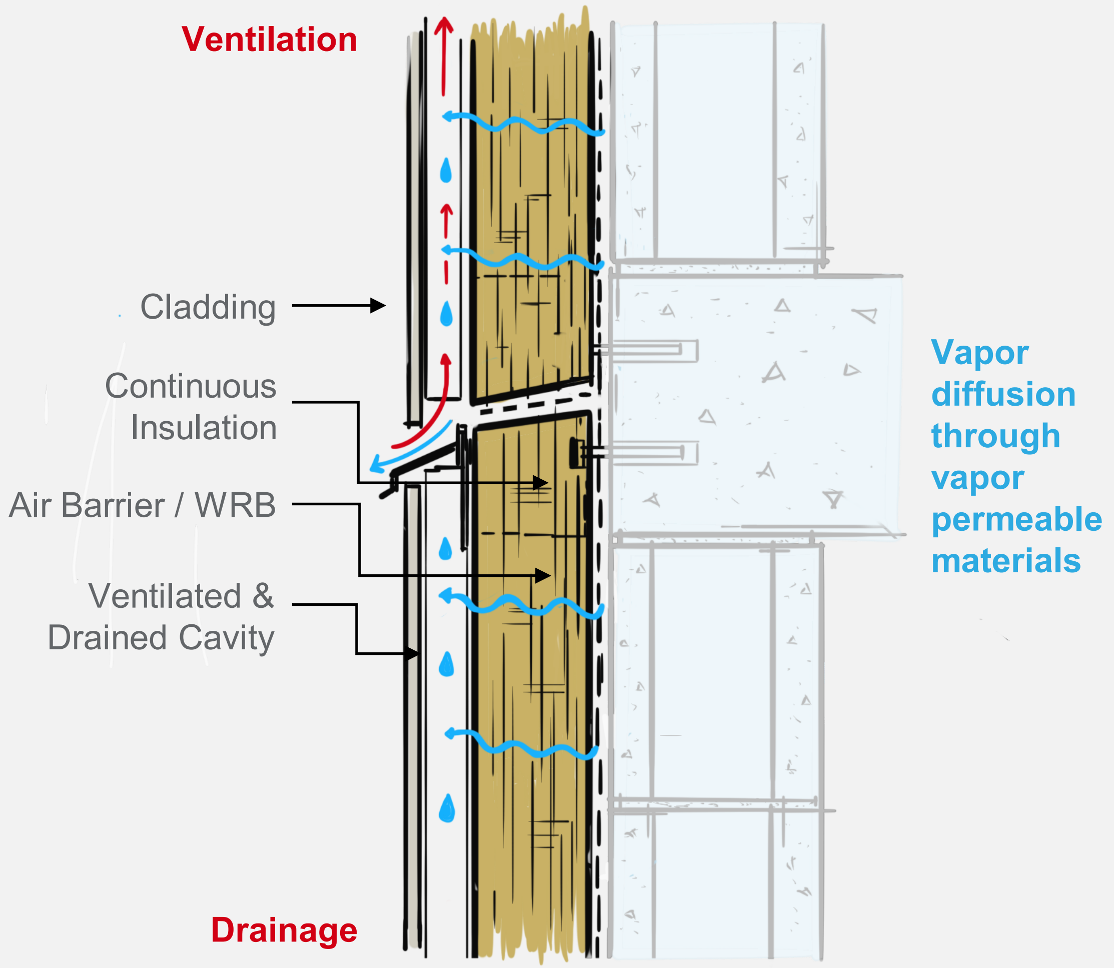
Retrofitting for enclosure durability

CONTROL LAYERS

Durable, Moisture Tolerant Enclosures

Hygrothermal properties must allow for drying without excessive moisture accumulation.

- Consider wetting mechanism
- Consider vapor retarder requirements based on climate (interior vs. exterior)
- Consider permeability of all materials (permeable vs impermeable)
- Ensure continuity of control layers
- Drained screen assembly works best



CONTROL LAYERS

Interior vs. Exterior

An **exterior retrofit is generally more favorable** than an interior retrofit because it **improves building durability**, by reducing the likelihood of cold weather condensation within the structure.

Despite the advantages of exterior insulation, many buildings must be retrofitted on the interior, for reasons such as **historic preservation, zoning or space restrictions, or aesthetics.**

Retrofitting for enclosure durability

INTERIOR VS. EXTERIOR

Interior Insulation Retrofits:

- Optimal solutions for site with limited lot lines and historic preservation requirements
- Durability concerns with changing temperature profile of wall assembly and risk of condensation
- Airtightness is key
- Occupant disturbance

Exterior Insulation Retrofits:

- Exterior insulation reduces potential for condensation.
- Airtightness is key.
- Additional structural considerations for added insulation and cladding weight
- Requirements for noncombustibility may be of concern
- Lower occupant disturbance

Stone wool retrofit solutions

Rainscreen Overcladding System using Stone Wool Insulation

STONE WOOL RETROFIT SOLUTIONS

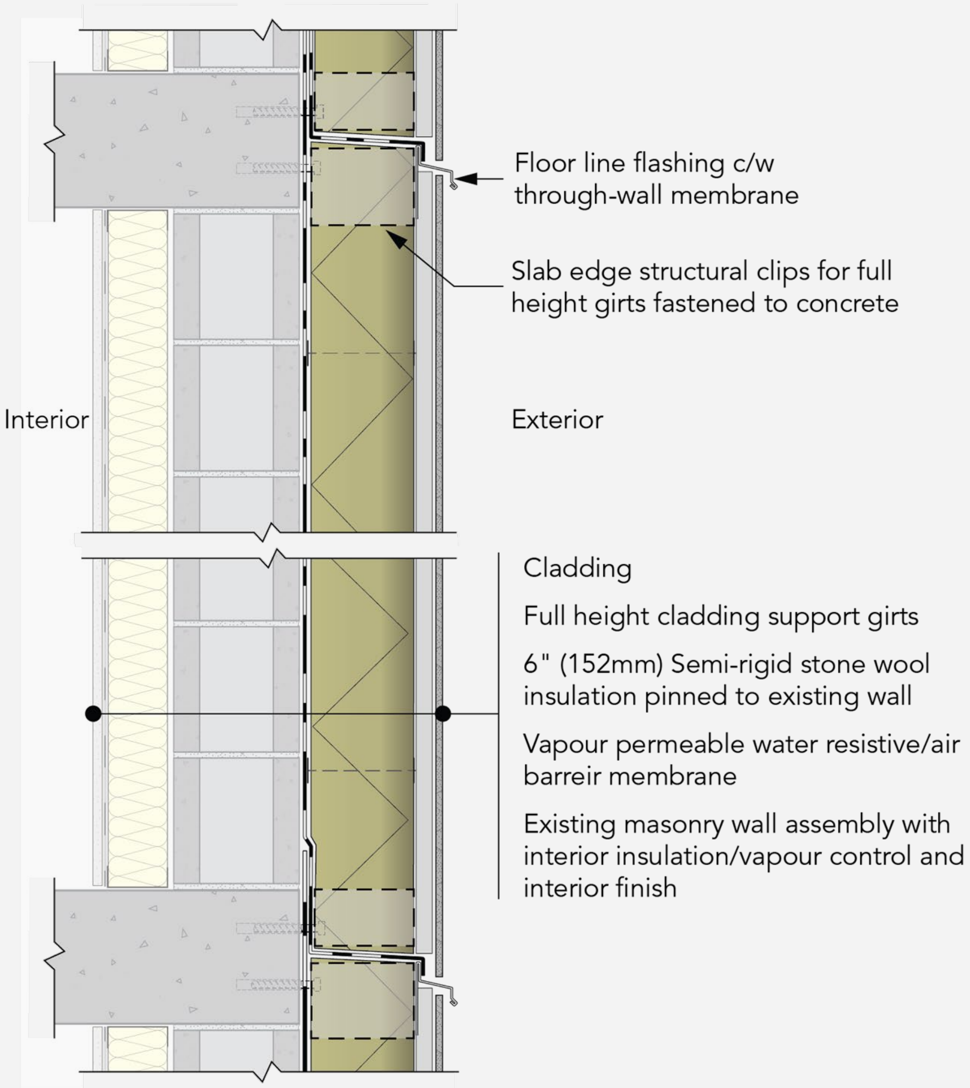
Exterior insulation retrofit using rigid or semi-rigid stone wool insulation in combination with a ventilated cladding.

Assembly layers:

- **Primary air control** ▶ membrane over existing substrate
- **Thermal control** ▶ directly fastened rigid or semi-rigid stone wool insulation boards b/w clip systems
- **Cladding** ▶ rainscreen cladding, cladding type depending on attachment method

Critical Considerations:

- Structural capacity of existing substrate
- Effective R-value requirements and attachment type
- Integration of exterior insulation with window details (existing or new windows)
- Fire resistance requirements



Section View

Rainscreen Overcladding System using Stone Wool Insulation - Micro-case study

STONE WOOL RETROFIT SOLUTIONS

210 E 79th St
New York, NY

Key Challenges:

- Built in 1963 with no insulation or waterproof membrane
- Exterior masonry highly deteriorated
- Local Law 11 in NYC which requires facade inspections represented significant expense and inconvenience to the co-op owners.

Owner: 201 East 79th Street Cooperative
Design Architects: Rogers Partners
Architect of Record: Rawlings Architects
Contractor: CM & Associates

▲

Exterior retrofit, window detail: porcelain rainscreen cladding over Semi-rigid, black mat-faced, stone wool insulation

Rainscreen Overcladding System using Stone Wool Insulation - Micro-case study

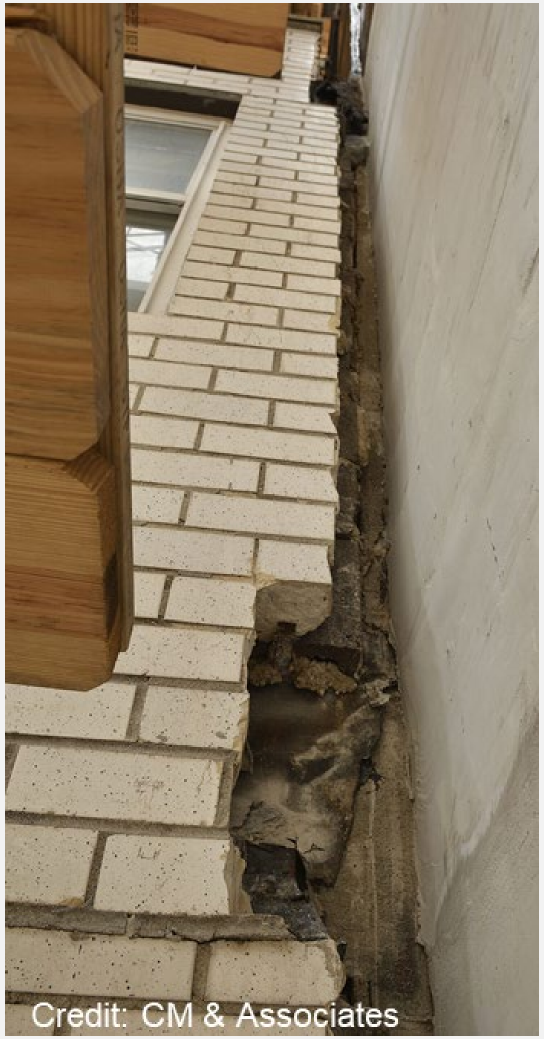
STONE WOOL RETROFIT SOLUTIONS

210 E 79th St
New York, NY

Goals:

- Remove brick and upgrade facade for long-term performance and energy savings.
- Meet PlaNYC 2030 carbon reductions goals of 30%
- Avoid compliance fines and reduce maintenance.
- Improve indoor comfort.
- Increase property value.
- Additional upgrades include window replacements, HVAC upgrades, and LED lighting in all public areas

Existing conditions:
White brick masonry over CMU substrate



Rainscreen Overcladding System using Stone Wool Insulation - Micro-case study

STONE WOOL RETROFIT SOLUTIONS

210 E 79th St New York, NY

▲
New fluid-applied water-resistive barrier over CMU substrate

▲
Exterior retrofit, window detail:
Semi-rigid, black mat-faced, stone wool insulation installed between metal clips

▲
Exterior retrofit, window detail:
porcelain rainscreen cladding over Semi-rigid, black mat faced, stone wool insulation

Stone Wool for EIFS

STONE WOOL RETROFIT SOLUTIONS

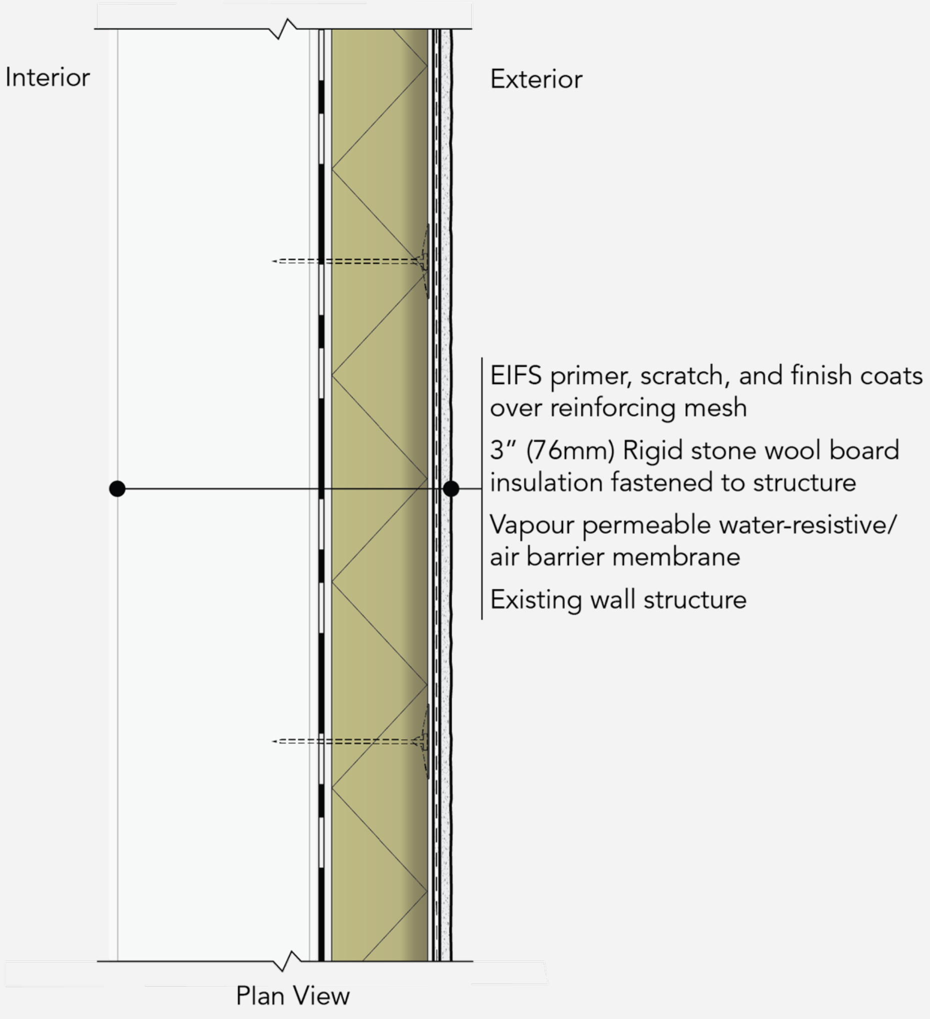
A noncombustible exterior insulation retrofit using a semi-rigid stone wool board for use in mechanically fastened exterior insulation finish systems.

Assembly layers:

- **Primary air control** ▶ membrane over existing substrate (existing or fluid applied)
- **Thermal control** ▶ mechanically fastened, rigid stone wool insulation
- **Cladding** ▶ finish render + reinforcing mesh

Critical Considerations:

- Drainage efficiency (adhesive ribbons or GDDC behind insulation board)
- Superior board quality & long-term durability
- Dual-density option for flush installation
- Fire resistance requirements



Stone Wool for EIFS - Micro-case study

STONE WOOL RETROFIT SOLUTIONS

Ken Soble Tower

Key Challenges:

- Deteriorating envelope
- Lack of insulation
- Mold and hazardous materials
- Lack of thermal control
- Systems at end of life

Architect: ERA Architects
Photo Credit: Cordrin Talaba

▲

Existing exterior substrate:
CMU plus brick masonry veneer, slab edges exposed (balconies taken down)

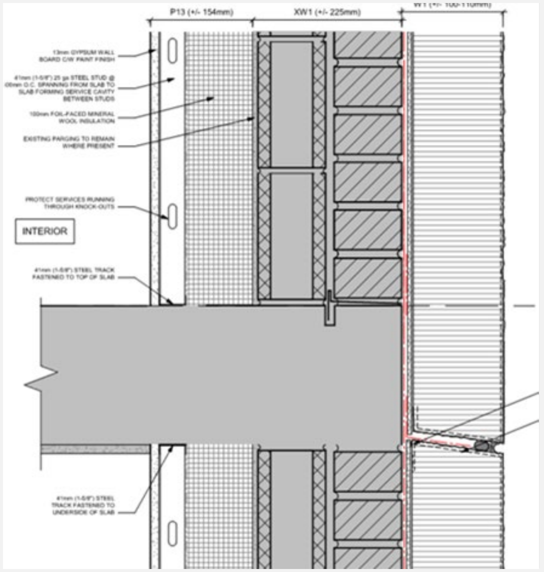
Stone Wool for EIFS - Micro-case study

STONE WOOL RETROFIT SOLUTIONS

Ken Soble Tower

Goals:

- Ultra-low energy retrofit that maintains affordability
- Reduce greenhouse gas emissions by over 90%.
- EnerPhit certified project
- Reduce thermal bridging to enhance indoor thermal comfort and limit heat loss.
- Passive climate resilience to extreme conditions
- Fire resiliency
- Adequate ventilation



Exterior wall retrofit build-up: Existing substrate, new fluid applied air/water barrier, 6” rigid stone wool EIFS

Photo Credit: Cordrin Talaba
Detail Credit: ERA Architects

Stone Wool for EIFS - Micro-case study

STONE WOOL RETROFIT SOLUTIONS

Ken Soble Tower

Credit: ERA Architects

Insulation board mechanically fixed with base coat applied

Exterior wall retrofit build-up:
6” rigid stone wool EIFS board integrated GDDC, reinforcing mesh and base coat

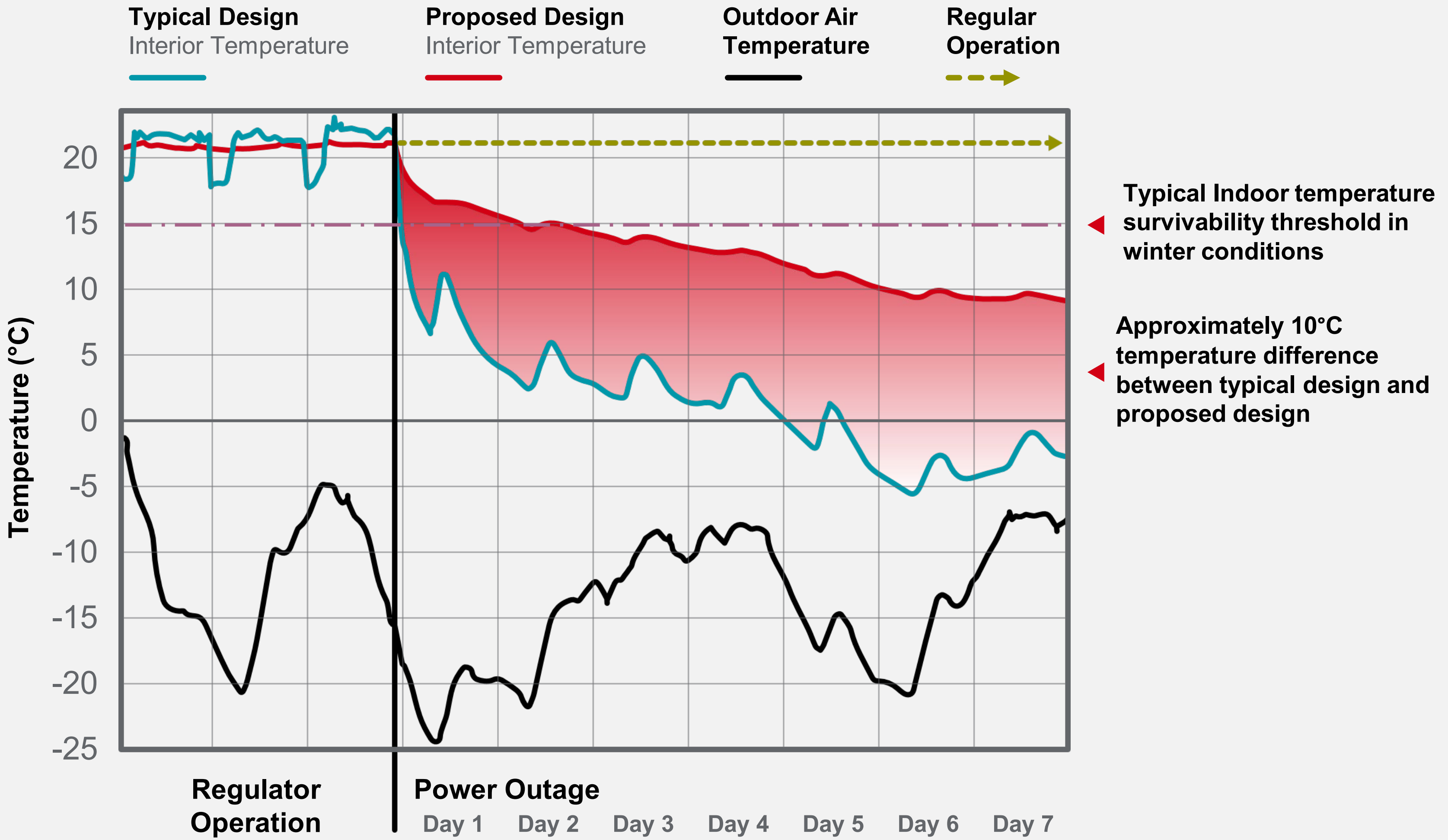
Stone Wool for EIFS - Micro-case study

STONE WOOL RETROFIT SOLUTIONS

Ken Soble Tower

Considering survivability:

- In case of failure of active systems, the building will stay warm in winter for up to two days (compared to 2 hours in a typical building) and below dangerous heat levels in summer for up to four days (compared to half a day in a typical building).



Interior Stone Wool Insulation Solution

STONE WOOL RETROFIT SOLUTIONS

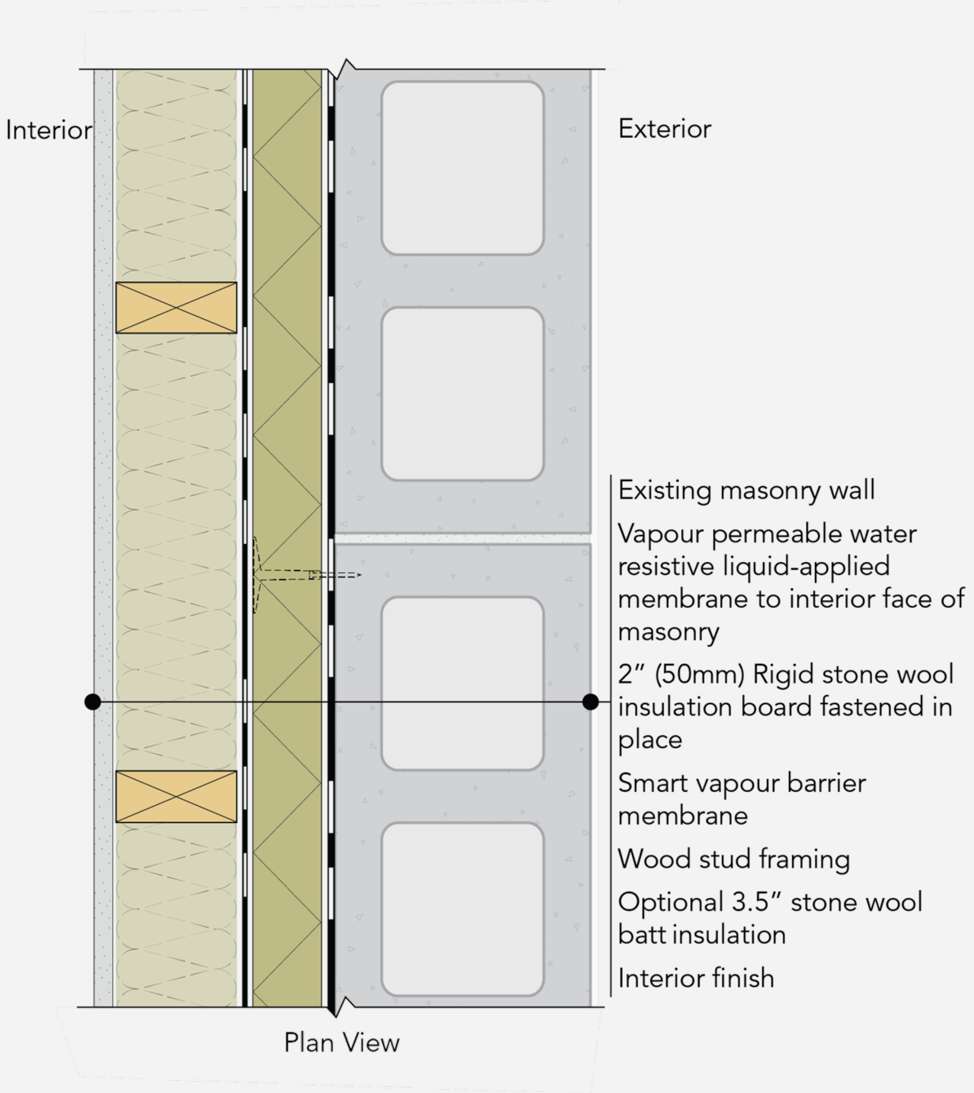
A smart Interior retrofit strategy using a combination of rigid stone wool insulation boards

Assembly layers:

- **Primary air control** ▶ fluid applied membrane
- **Thermal control** ▶ semi-rigid stone wool insulation
- **Vapor control (secondary air control)** ▶ smart vapor barrier

Critical Considerations:

- Characteristics and condition of existing brick masonry wall
- Appropriate insulation levels to manage freeze-thaw potential
- Enabling interior drying



STONE WOOL RETROFIT SOLUTIONS

1701 Albemarle Rd. Brooklyn, NY

Key Challenges:

- Efficiency, sustainability, and occupant wellness
- Compliance with Local Law 97
- Adhering to Passive House standards
- Maintaining the historic integrity of the building as a whole.

Architect: Scott Henson

▲

Existing exterior substrate:
6 storey brick masonry multi-unit apartment building

Interior Stone Wool Insulation Solution – Micro case study

STONE WOOL RETROFIT SOLUTIONS

1701 Albemarle Rd. Brooklyn, NY

Goals:

- Improve thermal comfort and acoustics.
- Achieve PH standard level of airtightness.
- Ensure strategy is durable with limited risks of damage to the existing brick wall.
- Compare pre- and post-performance.
- Use this project as a “template” for how retrofits in this archetype can be achieved.

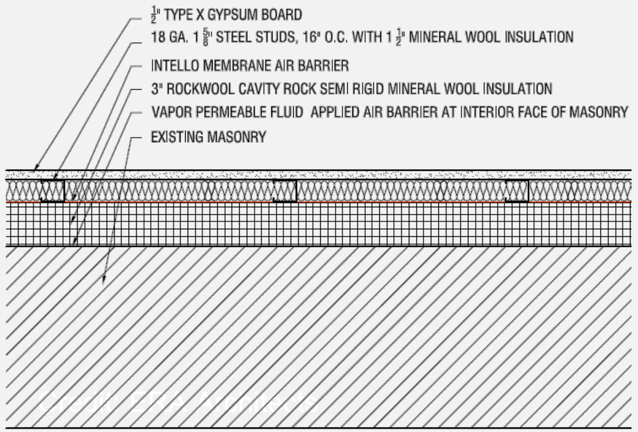
▲
Pre-retrofit build-up:
Existing wall substrate, existing masonry wall, no air barrier, single-pane windows

▲
Post-retrofit build-up:
3” rigid stone wool insulation over existing brick masonry and fluid applied vapor permeable membrane. Smart vapor barrier to tie into ceiling air barrier.

Interior Stone Wool Insulation Solution – Micro case study

STONE WOOL RETROFIT SOLUTIONS

1701 Albemarle Rd. Brooklyn, NY



▲ Typical exterior wall detail
Credit: Scott Henson Architect

▲ **Exterior wall retrofit build-up:**
Exterior wall retrofit build-up: existing brick masonry, fluid applied vapor permeable membrane, 3” rigid stone wool insulation.

▲ **Exterior wall retrofit build-up:**
fluid applied vapor permeable membrane installed over existing masonry wall as primary air barrier.

Interior Stone Wool Insulation Solution – Micro case study

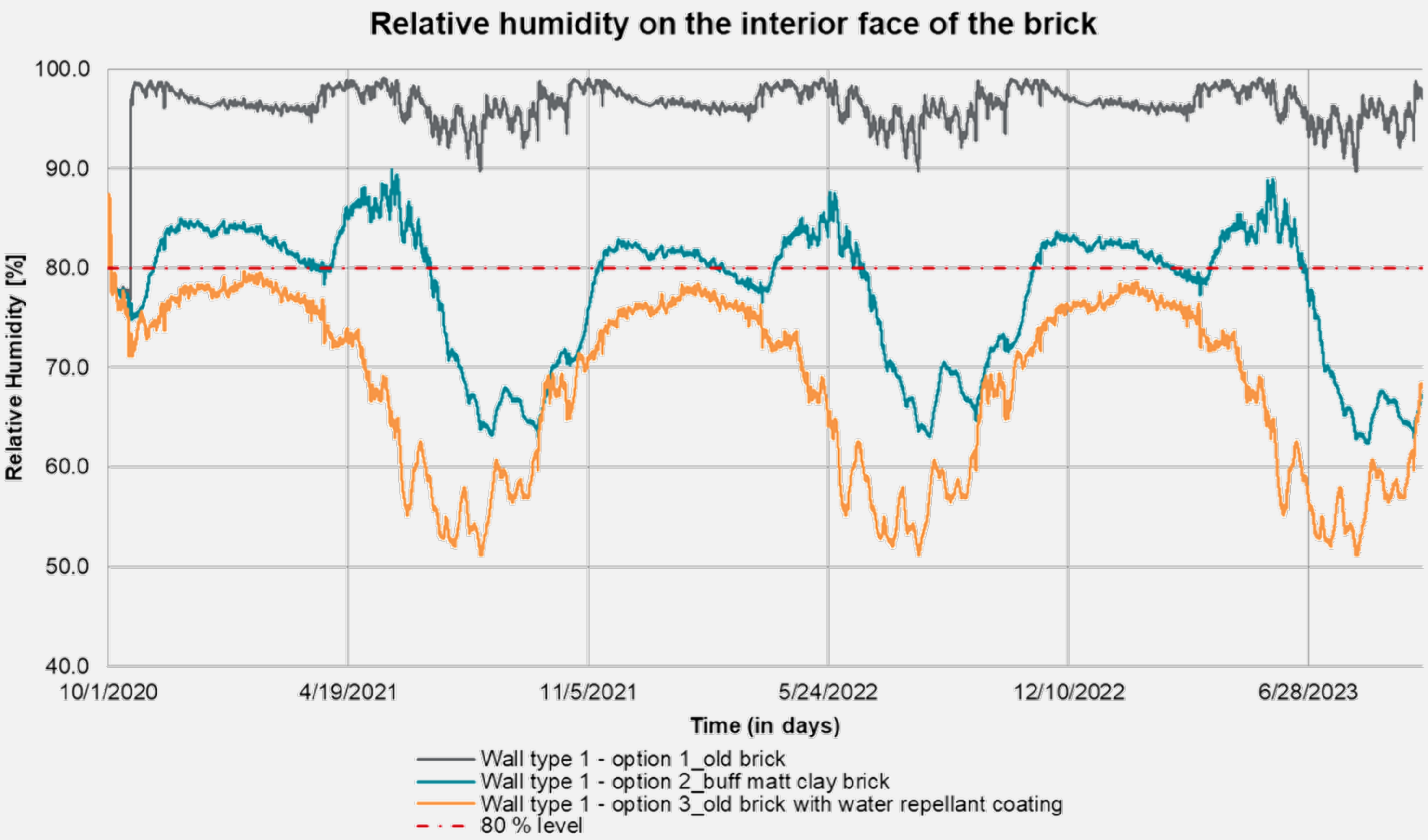
STONE WOOL RETROFIT SOLUTIONS

1701 Albemarle Rd. Brooklyn, NY

Moisture considerations:

- ROCKWOOL Building Science modelled several wall types to understand potential for moisture and potential for mold growth.
- Of note is the 80% humidity mark. Any instance of prolonged exposure indicates potential for moisture issues within the assembly.

Credit: ERA Architects



Acoustic capabilities

SIMPLICITY AND RESILIENCY

Cities that never sleep won’t keep you awake.

Stone wool insulation turns down the volume of the city.

- Isolate and control vibrations and noise
- Can reduce up to 8x the perceived impact noise coming from the floor above when insulating your floor with ROCKWOOL stone wool
- Can hear half the rain noise from outside when insulating a metal roof with stone wool compared to when insulating with other kinds of insulation

In schools with no sound absorption, children miss

25%

of words spoken by their teacher.

Robustness

CREATING NEXT GENERATION BUILDINGS

Welcome to buildings that fashion the future.

Stone wool insulation builds cities fit for the future.

– Stone wool insulation is 3 to 5x the density of traditional batt insulation, and it ¾” wider than standard stud framing for a lasting friction fit in stud cavities.

– Unique physical structure that keeps it's shape and toughness despite changes in temperature or humidity

– Thermal properties, dimensions, and thickness of Stone wool products do not deteriorate during its lifetime.

3/4”

Larger than 16” and 24” on center cavity sizing

Thank You

This concludes the continuing education unit on the course: **Durable & Resilient Retrofits –Solving with stone wool insulation.**

Thank you for your interest in ROCKWOOL.

For more information, visit www.rockwool.com

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Paris Agreement 2015 and Agenda 2030

Landmark Paris Agreement to combat climate change and **accelerate and intensify actions and investment** for a sustainable low carbon future.

Key goal is to keep a global temperature rise this century **well below 2°C above pre-industrial levels** and to pursue efforts to limit it even further to 1.5 °C.

Agenda 2030 is the plan for action for Sustainable Development by setting focus on **17 Sustainable Development Goals to be achieved by 2030.**