TIGHTHOUSE

Brooklyn is a hub of innovative architecture and design. Dozens of young professionals are commissioning or undertaking their own eco-sensitive renovations to existing brownstones and low-rise attached buildings throughout the borough. Tighthouse is centrally located off of Fifth Avenue in the neighborhood of Park Slope. This Passive House retrofit brownstone sits at the end of a string of two-story buildings constructed in 1899 that share a tree-lined block with larger brownstones built around the same time. It is the first certified Passive House in New York City and meets the standards for new construction, surpassing the EnerPHit certification.

The unique retrofit of a 110-year-old house by the Brooklyn-based firm Fabrica718 could serve as an important model for the many urban and suburban residences that need energy-saving renovations. Much more so than new construction, each Passive House retrofit involves its own singular set of conditions that demand creative problem solving and meticulous attention to insulation.

The owners of Tighthouse, a young couple from Ohio, considered the long-term benefits of a low-energy Passive House and understood that this gut renovation was a unique opportunity to comprehensively insulate their building. It is no wonder that the clients, who grew up in an age of smartphones and have little tolerance for inefficiency, were attracted to the idea of a Passive Home, which is nothing other than a smart and innovative machine for living. The couple's Midwestern pragmatism helped set the stage for finding efficient solutions to every aspect of the renovation, including the lighting, audiovisual, security, and mechanical systems.

The growing family required slightly more space than the brownstone's original plan provided. Fortunately, local zoning regulations permitted the architects to add an additional story to the building. The new penthouse added enough space to include an art studio for the husband in the building's basement. The top-floor master bedroom is defined by the new roof's bold angles, sloping twenty-one degrees and oriented along the north-south axis. This tilted and turned roof was designed to maximize exposure to the light and heat of the sun for solar thermal and photovoltaic collectors.

A penthouse mechanical room holds an HRV unit, located in the house's top story to provide cleaner air than would be available at street level and to ensure that the air intake and exhaust ducts to the exterior are kept short. The white acrylic roof is finished with an eco-friendly surfacing material that reflects the sun but does not add contaminates to the rainwater-collection barrels used for irrigating the garden and plants on the roof terrace and in the rear yard.

After a lengthy investigation into the best method to insulate the existing front facade, Fabrica718 decided to apply a layer of exterior insulation and finishing system (EIFS). Because of the extreme temperature differential in New York City, insulating the building from the inside alone can cause a freeze-thaw condition that could harm the masonry wall. (This fear was validated during a winter without occupants—one of the original brick walls cracked because of what looked to be freeze-thaw damage.) The existing brownstone facing would be spalling and degraded. Once construction started, it became

40° 40'

Brooklyn, New York

Fabrica718

2012

Certified by PHI

OPPOSITE: **South-facing facade of the Tighthouse retrofit. The degraded brownstone face veneer was replaced with an EIFS system to provide exterior insulation. The cornice is fiberglass made from a mold of the original. Replacing the original wood cornice allowed for a continuous thermal envelope and air seal at the existing facade.**

evident that it would be better to remove the four-inch face veneer and apply the EIFS, which is similar in appearance to brownstone but more affordable, to the existing masonry. This would not only cut costs but also keep the finish in the same plane with the neighboring building. Most of the three-wythe masonry wall remained in good shape, but areas below the windowsills had to be restored with concrete masonry units (CMU), as the deteriorated stone sills had to be removed. The building's original wood cornice was replaced with a low-maintenance fiberglass replica, which was installed over the EIFS, allowing for a continuous thermal envelope.

On the rear facade, a rainscreen features an air barrier, four inches of rigid mineral wool insulation, and a thermally isolated framing system clad with cement panels, which are durable and low maintenance. Providing both insulation and character to the building, the custom rainscreen panels range in height across the facade to align with window openings and play on typical wood-siding houses often seen in old Brooklyn.

The double-height art studio in the basement consists of a concrete slab that required intricate detailing to meet Passive House standards and satisfy structural and waterproofing requirements. Any penetration through the building's superenvelope could throw off its airtightness, and a failure to stop thermal bridging at the perimeter cellar slab would mean significant heat loss. Fabrica718 collaborated with structural, geotechnical, and Passive House consultant ZeroEnergy Design and decided to line the bottom and the perimeters of the slab with two inches of XPS insulation. A gravel bed and perforated pipe drainage system underneath the slab leads to a sump pump, and a polyethylene membrane just below the slab prevents ground moisture from migrating into the interior space.

Since air sealing of existing stairs can be difficult in retrofit projects, the architects designed new stair openings at each level of the house—the art studio in the basement, a guestroom at the garden level, an open parlor floor for entertaining, a second floor with a home office and children's bedroom, and the master bedroom penthouse and roof terrace. The new staircases allowed the contractor to efficiently air seal the walls before reinstalling the stairs. In addition, the five sets of stairs became a unifying feature in the house, with their visually exciting but cost-effective design. The plate-steel stringers and perforated stainless-steel treads add special character to the home. The durable and low-maintenance material does not require a finish coat, and the stairs' perforated pattern provides a strong graphic element while bringing natural light to the center of the row house. The stairs are bound by clear glass and, along one wall, a simple handrail that houses LED ribbon lights controlled by eco-timers.

After implementing techniques to maximize daylight at the stairwells, Fabrica718 worked with the clients on a lighting strategy for the rest of the house based on using LED and fluorescent lights limited to five types of fixtures. The challenge was to create gallerylike lighting conditions for the couple's art collection and the studio. The owners eventually opted to install low-cost down lights and track lighting fixtures with the highest-quality retrofit LED bulbs available.

The clients' minimalist aesthetic kept the project unadorned, contributing to the architects' overall goals of energy efficiency and simplicity. Reclaimed materials were used for the industrial flooring on all levels as well as in specific areas of the house, including the parlor space, where a wythe of reclaimed brick was added to coincide with the ceiling opening. This brick was salvaged from the two fireplace flues that were demolished on-site. Custom designs by Brooklyn fabricators include the stainless-steel LED strip lights at the top of each stair landing, which are practical, made locally, and add character to the space.

LEFT: **Hardboard rainscreen on the new CMU rear facade. The rainscreen system is detailed with a vapor-permeable air and water barrier, mineral wool insulation, and a thermally isolated furring channel system.**

RIGHT: **Roof-terrace garden space with insulated parapet walls, local bluestone pavers, and high performance south-facing windows. The penthouse has the same rainscreen system as the rear facade.**

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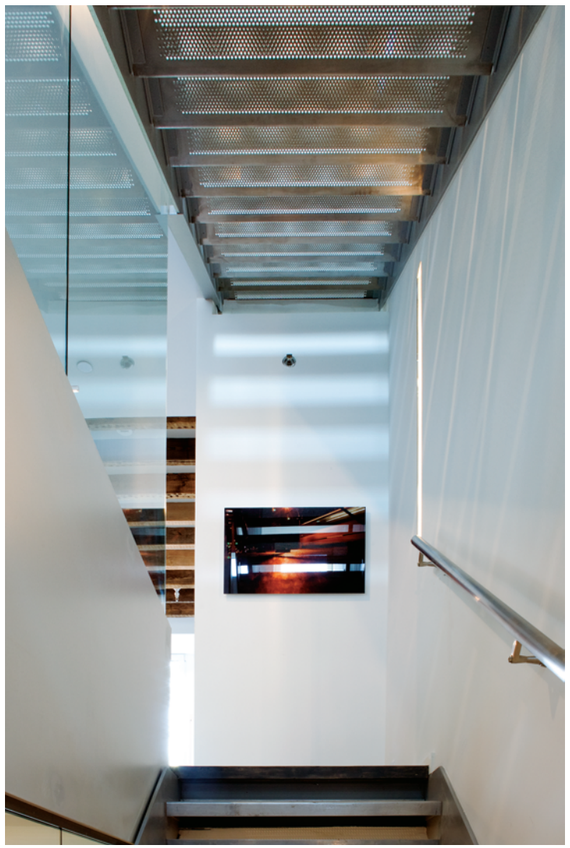
LEFT: **Each landing has a custom recessed wall-mounted LED light fixture, visible on the right.**

TOP RIGHT: **Reclaimed brick, salvaged from the chimney flues that were removed, lines the stair opening above.**

BOTTOM RIGHT: **Parlor level with new openings and perforated open-riser stairs bringing in natural light to the middle of the rowhouse**

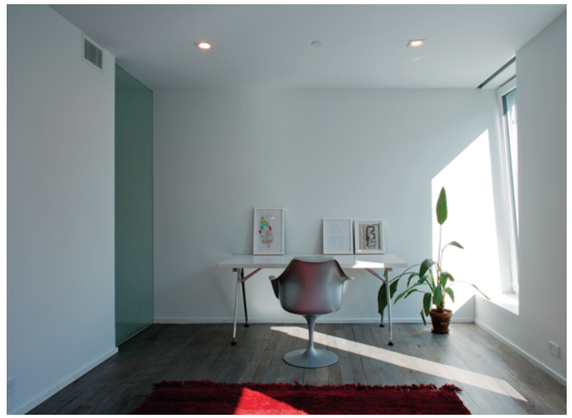


RIGHT: **Glass panels at the second-floor stairs allow for light from the skylights above to pour into the second-floor hallway.**

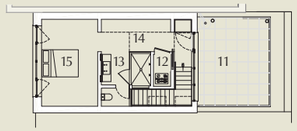
LEFT: **View looking back to brownstone entry door below and an interior glass panel in the second-floor home office. The handrails are outfitted with hidden LED strip lighting.**

TOP RIGHT: **The second-floor home office has an interior window to the stairs and large tilt-and-turn windows that look out to the pear tree in the front yard.**

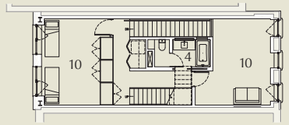
BOTTOM RIGHT: **Master-bathroom area with natural light from skylight above. The shower room is tiled in custom black concrete panels and the large interior window provides a sill for storage.**



1 MECHANICAL ROOM
2 ARTIST STUDIO
3 GUEST ROOM / OFFICE
4 BATHROOM
5 GARDEN
6 LIVING ROOM
7 KITCHEN / DINING ROOM
8 POWDER ROOM
9 STAIR TO GARDEN
10 BEDROOM
11 ROOF DECK
12 HRV / MECHANICAL ROOM
13 MASTER BATHROOM
14 HALLWAY / CLOSET
15 MASTER BEDROOM



FOURTH FLOOR



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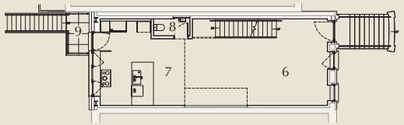
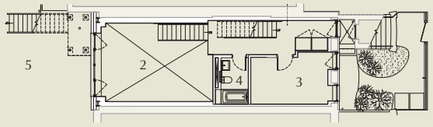
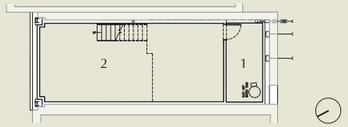


SECOND FLOOR



FIRST FLOOR



BASEMENT

BELOW: **Diagram of the perforated stair treads that allow daylight to reach into the house's interior**