

An architectural rendering of a tall, modern brick building with a grid-like facade of windows. A large red rectangular overlay is positioned in the upper right, containing white text. Below the red overlay, the building's facade is visible, featuring a mix of brick and dark window panels. A wide, multi-level outdoor staircase with greenery and people is on the left. The ground level shows a busy plaza with people walking and bicycles parked. The word 'DREAM' is visible in large letters above a glass entrance on the right.

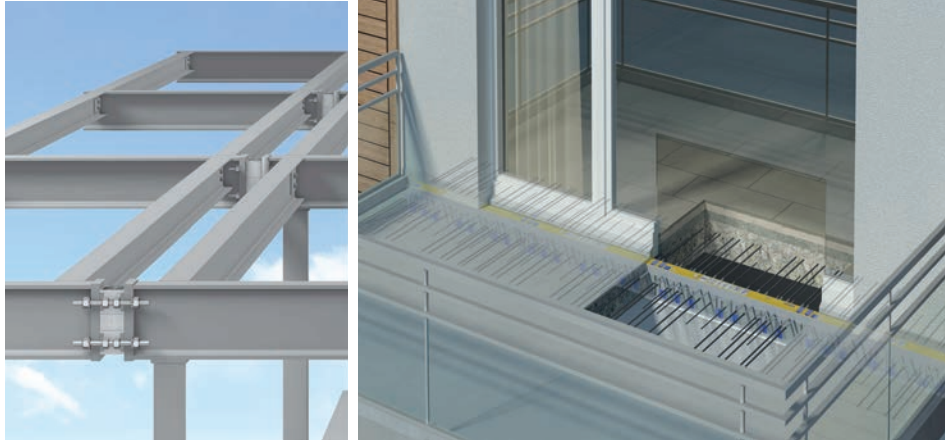
FROM
SMALL TO

EXTRA LARGE

Passive House Rising to New Heights

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Isokorb® structural thermal breaks for concrete construction (left) contain engineered stainless steel rebar for casting into interior and exterior sides of the penetration. Isokorb® structural thermal breaks for steel construction (right) bolt interior steel structures to cantilevered balcony supports, canopies or rooftop connections.



FROM
SMALL TO
EXTRA LARGE

Passive House Rising to New Heights

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From Small to EXTRA LARGE

by Andreas M. Benzing

Mayor Bill de Blasio has called climate change “the challenge of our generation,” and New York City has responded to this challenge by committing to achieving greenhouse gas reductions of 80% by 2050. “The leadership shown by Governor Cuomo and New York State to make bold emissions reductions commitments is vital to solving the climate crisis,” says former Vice President Al Gore.

Passive House buildings, which achieve substantial energy reductions and resiliency through cost-effective and skillful design and construction, are key to achieving these commitments. These buildings use up to 90% less energy for heating and cooling, and up to 70% less energy overall, than conventional buildings do. And in the event of a power outage, they can remain comfortable for many days even in extreme weather. With its substantially lower energy requirements, the Passive House approach makes possible the construction of net zero energy buildings that rely little or not at all on fossil energy sources. By reducing energy demand, this approach contributes to the nation’s security.

In New York the Passive House building sector is growing rapidly, and the domestic building product manufacturing sector has been energized by this expanding market. This rapid growth is clearly illustrated in *From Small to Extra-Large: Passive House Rising to New Heights*, which showcases 51 new-construction and renovation projects, from small homes to skyscrapers. New York City is fast becoming the Passive House epicenter of the country.

The area’s skilled professionals and building trades, its innovative business environment, and its financing and political leadership are leading the state’s economy forward into a comprehensive and transformative clean-energy future.

The economic benefits to our state are significant. Job opportunities in the Passive House construction industry are in high demand. Specialized skills are required for implementing Passive House design; these represent real opportunities for job growth and massive economic expansion.

It is exciting to see the application of Passive House evolving from small single-family homes to extra-large skyscrapers. New York Passive House is committed to advancing policy that recognizes the critical contributions of low-energy, high-performance Passive House buildings to support our state’s clean-energy transformation.

ANDREAS M. BENZING is president of *New York Passive House*.



Photo by UGC

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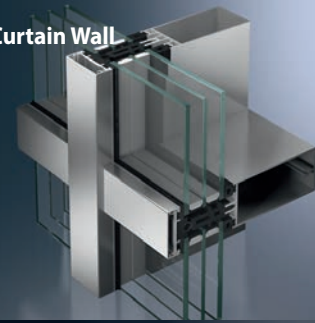
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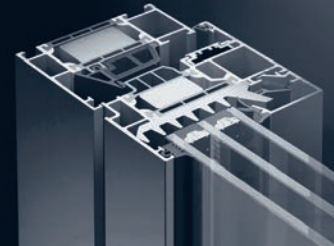
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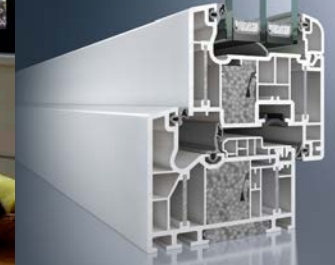
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Passive House in the URBAN Context

by Dr. Wolfgang Feist

Governments worldwide and at every level are tasked with delivering affordable, high-quality buildings at high-performance levels. This responsibility applies to both new builds and the existing building stock. As more and more people move to urban centers, this outcome is particularly important for the development of cities. The worldwide migration to urban centers has led cities to seek solutions on how to reduce carbon in the built environment in a reliable, cost-effective manner, as increasing population density requires a sustainable-energy solution. Passive House provides that solution!

Passive House stipulates high energy performance and has an international track record of proven energy savings compared to conventional buildings—up to 90%

More and more communities are choosing to follow a policy of Passive House development because it is a future-proof, resilient solution.

unprecedentedly high thermal comfort and also reduces the peak power demand significantly, thus reducing the pressure on urban infrastructure. Peak demands of less than 10 W/m² (0.9 W/ft²) can easily be met by an electric supply chain—and that again facilitates a completely sustainable and renewable supply.

Passive House works on a large scale; the Bahnstadt district in Heidelberg, Germany, has been one of the many Passive House community successes and will soon be joined by another Bahnstadt in Gaobeidian, China. With 37 buildings and over 1.2 million square meters of living space, this will be the largest Passive House settlement in the world.

More and more communities are choosing to follow a policy of Passive House development because it is a future-proof, resilient solution. The high-quality construction and attention to detail ensure that Passive House buildings have a long life cycle, and the ventilation systems found in Passive House buildings provide plentiful fresh, pollen-free and almost dust-free air, providing the best possible indoor air quality. This maximizes comfort and health for all, especially in an urban context where air quality can be a concern. This combination's result is clear: Passive House is the solution for urban contexts.

DR. WOLFGANG FEIST is a professor at University of Innsbruck and director of the *Passive House Institute*.



Photo courtesy of the Passive House Institute

reductions in heating and cooling energy are complemented with total primary energy savings, taking all energy services of a building into account. As energy savings equal emissions reductions, Passive House is a sustainable alternative to conventional construction. The fabric-first approach makes possible



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New York's Path to SCALING UP Passive House

by Richard C. Yancey, AIA, LEED AP

The proliferation of Passive House buildings in New York today arose within the context of increasing recognition of the seriousness of climate change. In 2007, then-Mayor Michael Bloomberg released PlaNYC, a sustainability plan for New York City. PlaNYC drew up a bold agenda for creating a “greener, greater New York,” which included the goal of a 30% reduction in carbon emissions by 2030, compared to 2005 levels. By enumerating the large contributions that buildings make to the city’s carbon emissions, the plan elevated the stature of real estate as an important partner in fighting climate change.

PlaNYC prompted a cascade of legislative changes. In 2009, the mayor signed Local Law 84, which required annual benchmarking and reporting of energy and water use in New York City buildings with more than 50,000 gross square feet—nearly 50% of the city’s square footage. In 2016, Local Law 133 expanded the list of covered buildings to include those with more than 25,000 gross square feet, adding another 17,000 buildings. In addition to benchmarking, every ten years these covered buildings must undergo an energy audit and commissioning process to both tune up existing equipment and identify all cost-effective measures to improve their efficiency.

A related law, Local Law 88, requires that all nonresidential covered buildings upgrade their lighting to meet the latest energy code by 2025, triggering the adoption of newer, dramatically more efficient lighting technologies. Still another local law closed an energy code loophole, requiring for the first time that partial renovations—a category that includes most of the city’s construction projects—meet the energy code.

This drumbeat of energy-related laws reflects New York’s increasing understanding of its vulnerability in the face of climate change. Other shocks to the system have also upped the ante, such as the devastating Superstorm Sandy in 2012, and the People’s Climate March in 2014, when roughly 400,000 people took to the streets to call for climate action. Shortly afterward, in September 2014, Mayor Bill

de Blasio announced New York City’s commitment to achieving an 80 x 50 target, reducing carbon emissions by 80% by 2050, with an interim target to reduce emissions 40% by 2030. To lead by example, the mayor committed all new municipal buildings to meeting very aggressive efficiency targets, with Passive House as a compliance path. And in response to the Trump Administration’s withdrawal from the Paris Climate Agreement, Mayor de Blasio signed an executive order committing New York City to meeting the principles of that historic agreement, most importantly the 1.5°C global warming limit.

More recent developments include new energy stretch codes for the city, including a performance-based energy code in 2025 that is expected to have targets similar to those of Passive House. The city will also require buildings covered by the benchmarking law to publicly post letter grades in their lobbies, based on their annual Energy Star score. Other legislation has been introduced that will cap fossil fuel use in existing buildings.

In parallel with these legislative efforts, a growing group of architects, designers, and builders has been educating, training, and occasionally cajoling clients to adopt the Passive House standard for their projects. What started as a few enthusiastic architects working on brownstone renovations in Brooklyn has spread to Passive House buildings that span every size and type, thanks in no small part to the organizing efforts of New York Passive House.

Of course Building Energy Exchange also has played its part, as a center of excellence in training related to building efficiency. With our new expanded exhibit space and connected classrooms that opened earlier this spring, we look forward to continuing to deliver unparalleled educational experiences to ever-greater numbers of building owners, developers, architects, and all members of the real estate community.

RICHARD C. YANCEY is the executive director of *Building Energy Exchange*.

NYC TIMELINE

2007—PlaNYC released, Mayor Bloomberg’s master plan, including 30% reduction in GHG by 2030.

2009—Green Greater Buildings Plan, suite of four new local laws (LL) for all large buildings:

- **LL84**—requires annual benchmarking, reporting, and public disclosure of building energy and water usage;

- **LL85**—NYC Energy Conservation Code, closed partial renovation loophole;

- **LL87**—requires energy audit and retro-commissioning (every 10 years);

- **LL88**—requires lighting upgrades to meet code for all large non-residential buildings by 2025.

2009—Incorporation of the Building Energy Exchange (BEEEx).

2010—Creation of New York Passive House organization.

2012—Superstorm Sandy hits, causing 53 deaths, \$42 billion in damage, and destroying 100,000 homes in NY alone.

2014—People’s Climate March brings 400,000 to NYC streets to fight climate change.

2014—Mayor de Blasio speaks at UN and releases 10-year plan, One City Built to Last.

2015—Official launch of BEEEx’s downtown resource center.

2015—BEEEx produces sold-out event, Passivhaus: Lessons from Europe, which provides a briefing on fact-finding mission to Brussels. BEEEx also provides several high-level briefings to NYC and NYS policy-makers.

2015—Mayor de Blasio announces the creation of the New York City Retrofit Accelerator, a free advisory service to help building owners make energy efficiency improvements to their buildings. Accelerator will include a High Performance Track.

2015—BEEEx releases briefing, *Passive NYC; A snapshot of low energy building opportunities, barriers, & resources.*

2016—Mayor de Blasio releases *One City Built to Last, Technical Working Group* report, which sets stage for

- plans to address existing building GHG reductions
- creating whole building energy performance targets
- including mid-size buildings (25,000 ft² & up) in benchmarking requirements
- references creating an exemplary buildings program, similar to Brussels' successful BatEx competition

2016—NAPHN16 conference & expo, Decarbonize our Future Today, hosted in NYC.

2016—LL31 passed, establishing aggressive high performance targets for all new NYC buildings (Passive Standard is a compliance path option).

2017—In response to the Trump Administration's withdrawal from the Paris Agreement, Mayor De Blasio signs Executive Order 26, committing NYC to the principles of the Paris Agreement and a pathway to limiting global temperature rise to 1.5° C.

2017—The House at Cornell Tech opens in NYC, the world's largest residential high-rise built to Passive House standards.

2017—Mayor de Blasio proposes new legislation to limit on-site fossil fuel consumption, responsible for 40% of NYC GHG emissions.

2018—Mayor de Blasio signs new laws:

- LL32, Stretch & Performance Codes: aggressive reductions in 2019 and 2022 energy codes, with 'passive-like' performance targets, by 2025.
- LL33, Building Energy Grades: requiring publicly posted building energy grades, based on Energy Star scores, starting in 2020.

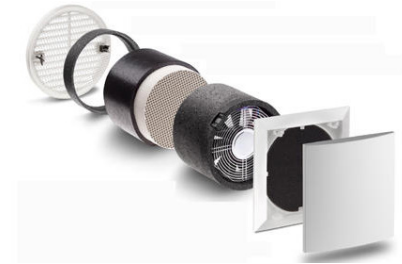
2018—BEEEx, Brussels Capital Region, NYC Sustainability, and NYPH partner to produce public exhibit, Icebox Challenge NYC, located near Times Square.

2018—BEEEx launches its Passive House Primer, a free one-hour seminar on Passive fundamentals delivered in the offices of building owners, managers, and designers.

2018—Official launch of \$1.5m expansion of BEEEx's downtown resource center, including a new connected classroom.

2018—BEEEx opens new exhibit, *CelebrateNYC; Building a Sustainable City*, featuring 60 energy efficiency retrofit projects, ranging from lighting upgrades to Passive House/EnerPHit renovations.

2018—BEEEx to release new report, *Pursuing Passive: Strategies for a High Comfort, Low Energy Retrofit in NYC.*



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BARRY PRICE Architecture



Architect Barry Price established his firm in 1994 with a focus on designing and producing buildings that retain an awareness of their relationship to the environment. Almost 25 years later, that principle has been elevated to the driver of his practice.

Price, who taught architecture at Vassar College for four years before the demands of his practice prevailed, sees his role as a combination of providing a service and being a didact. “I guide clients on a journey,” he says, “toward a greater understanding of architecture.” He continues to be a visiting critic and jury member at various design institutions.

Having completed projects in New York, New Jersey, and western Massachusetts, Price feels fortunate to have had commissions that are consistent with his principles. “There’s a moral imperative for architects to embrace strategies that advance carbon reductions, and this drives my work every day,” says Price. To that end he took the Passive House training several years ago and has been successful in counseling clients to embrace Passive House as a program goal, using a fairly simple approach. “I’ve honed it down to three categories: comfort, durability, and energy efficiency,” he states. He has yet to encounter any serious client who would not want to be the beneficiary of this approach.

“Passive House is not a discipline that targets a particular demographic,” Price points out. Two of his recent projects were thematically quite different in that one was a high-end custom home and the other was relatively affordable for commissioned architecture, yet both achieved Passive House targets. “The cost premium can be there if a building is complex,” he says, “but a building can be simplified to make Passive House cost-effective to implement.”

Price sees Passive House design as a logical evolution in an architectural practice that has always embraced high-performance building. “I don’t look at eliminating thermal bridging as a limitation, but rather as a parameter that the forms of my buildings need to respond to,” he says.

Recently he was approached by a developer who is converting a century-old recreational resort property to an inclusive development that will balance the property’s natural amenities and its historical value. Plans include up to 20 new single-family dwellings—an ideal opportunity for applying Price’s Passive House expertise at a slightly larger scale.

Photo by Preston Schlebusch Photography



An integrated team consisting of the architect, builder, and manufacturer was crucial to ensuring that the construction met the homeowners' expectations. The builder is a certified Passive House designer, and the manufacturer's wall system was the first PHI-certified opaque component in North America.

By using panelized Passive House components, the construction time was reduced, the quality of the build and airtightness were assured, and the impacts on this remote site were minimized.



Products

Windows & Doors

M Sora by Ecocor

Ventilation

Zehnder America

Cabin 3000

Bearsville, New York

The owners dubbed this project Cabin 3000 to emphasize their recognition of a structure's longevity and the enduring consequences of all construction choices. Their project goals included minimizing the disturbance of, and impact on, this special setting. They also prioritized reducing the building's environmental footprint by sourcing materials with the lowest embodied energy and global-warming potential. Building a Passive House using prefabricated roof and wall assemblies helped meet all of these goals.

The framing timber that was used to assemble the wall and roof components is all Forest Stewardship Council (FSC)-certified, and the components are completely foam free. All of the exterior cladding and the interior flooring was cut and milled locally, no more than 20 miles from the site. The interior finishes were all low- or zero-volatile organic compounds (VOCs).

Team

Architect

Barry Price Architecture

Builder and Certified Passive House Consultant

Harmony Builders

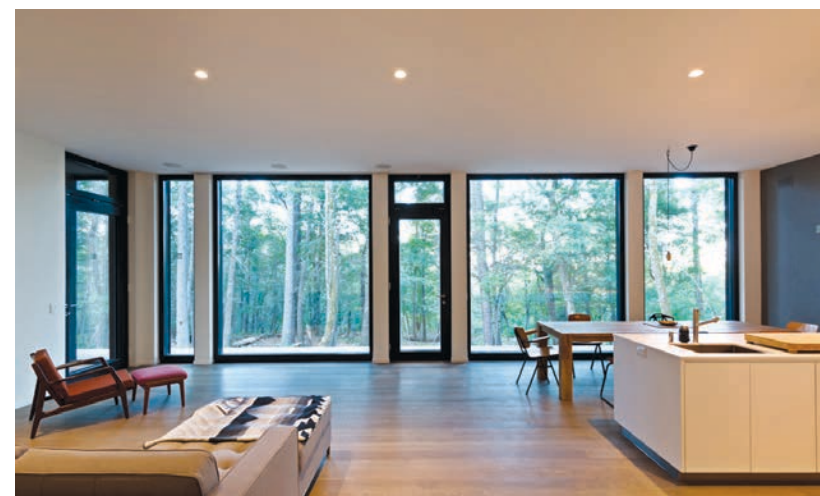
Wall and Roof Assemblies and Certified Passive House Consultant

Ecocor

Photos by Chris Kendall

Passive House Metrics

Specific space heating demand	4.44 kBtu/ft ² /yr	14 kWh/m ² /yr
Specific space cooling demand	4.12 kBtu/ft ² /yr	13 kWh/m ² /yr
Source energy use intensity (EUI)	34.24 kBtu/ft ² /yr	33.4 kWh/m ² /yr
Air changes per hour	0.28 ACH ₅₀	



A Country FARM

Pine Plains, New York

The clients came to architect Barry Price expressly seeking a house for themselves and their extended family that would minimally impact the rolling hills and sheltered valleys of this beautiful farm property. They were not familiar with Passive House, but once they were introduced to it, they embraced its environmental goals. Fortunately their hillside site faces south, affording panoramic views of the pastureland beyond.

Taking full advantage of this southern exposure, the long face of this two-story family compound is oriented to the south. Bedroom wings angle off of this linear shape to maximize the views from within. The large, triple-pane windows straddling the connection between the long mass and the angled wings are custom corner units—a challenge to specify, says Price, but he is very happy with the result. On the north-facing side, a 5-foot-square skylight brings daylight to the entrance stairwell.

The screened porch and carport are appendages to the main building. Price says working out the details of applying these appendages to the structure without penetrating the thermal envelope was essential to the home's integrated aesthetic and performance goals. Essentially they are freestanding steel structures over which he extended the rooflines while thermally isolating the roof connection. He achieved this by creating an insulated primary roof area over the main building and then overbuilding a secondary roof to accommodate all overhangs and porch roofs.

- Team**
- Architect**
[Barry Price Architecture](#)
 - Builder**
[Wolcott Builders](#)
 - Certified Passive House Consultant**
[Certiphiers](#)
 - Mechanical Engineer**
[Baukraft Engineering](#)



The home's foundation and basement walls rest in a lining of 8 inches of high-density EPS insulation, interrupting any contact between the structure and the ground. Above ground, 9½-inch truss joist I-beam walls, insulated with dense-packed cellulose, surround conventional 2 x 6 walls, also insulated with cellulose. A proprietary sheathing system forms the air barrier, topped on the exterior side by a weather barrier membrane. The ipe rain screen cladding is being applied horizontally utilizing its proprietary spacer system. Known for its durability, this floating ipe siding will epitomize the building's performance and durability goals.

This home was Wolcott Builders' first Passive House, and the two lead builders were excited to take on this challenge. Encouraged by Price, they took the Passive House builders' training to be able to guide their team and help achieve certification for the building.

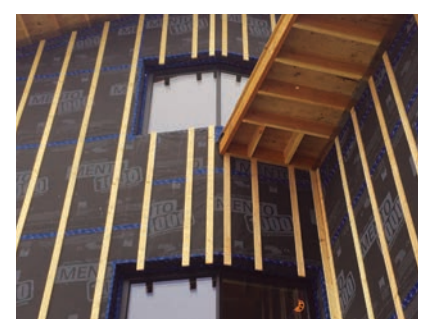
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- Air/Moisture Control**
[ZIP System Sheathing and Tape](#)
- Ventilation**
[Zehnder America](#)
- Skylights**
[Lamilux from 475](#)

Photos by Preston Schlebusch Photography

Passive House Metrics

Specific space heating demand	3.9 kBtu/ft ² /yr	12.2 kWh/m ² /yr
Specific space cooling demand	4.3 kBtu/ft ² /yr	13.6 kWh/m ² /yr
Source energy use intensity (EUI)	15.1 kBtu/ft ² /yr	47.6 kWh/m ² /yr
Source energy use intensity (EUI) (renewable)	10.6 kBtu/ft ² /yr	33.4 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	



Passive at NO PREMIUM

Woodstock, New York

Passive House performance wasn't on these clients' radar at first, nor, it seemed, within their budget, until they started working with architect Barry Price. The clients were looking to build a high-performance second home that they might eventually retire to. Once Price explained Passive House's environmental and resilience benefits, they were enthusiastic in theory but doubtful about the potential price premium, so Price developed plans for a home that met all their goals but didn't quite meet Passive House targets.

"I always design using 2 x 6 cores and then build out with exterior insulation," says Price. "For this house I specified a medium level of insulation that I thought would keep the building affordable." They got three construction bids from local general contractors and then sent the plans to Ecocor, a manufacturer and builder of certified Passive House panelized homes. On a square footage basis of comparable scope—framing, air/weather barriers, insulation, doors, and windows—Ecocor's bid came in at less than the others, allowing these owners to get Passive House performance at no cost premium.

Team

Architect

[Barry Price Architecture](#)

Builder

[Ecocor](#)

Mechanical Engineer

[Baukraft Engineering](#)



Set on a rural hillside site, this 2,200-ft² home has three bedrooms and two and a half bathrooms on two stories. The wall assemblies consist of 2 x 6 framing, a proprietary sheathing that functions as the air barrier, 11 7/8-inch truss joist I-beams (TJIs) stuffed with cellulose, a weather barrier, and strapping to form the rain screen gap. The siding is pine shiplap with a combed finish.

The foundation presented the home's biggest technical challenge. The site harbored a sloped ledge, so creating a level tabletop required a cut-and-fill approach. The home rests on a raft slab set in an insulated-foam skirt of different densities, engineered to absorb both uniform and point loads.

With the hill to the north behind it, the home faces south overlooking open views. The painted standing-seam metal roof, with its generous overhangs for shading, echoes the property's topography. Ecocor's roof assembly consists of 16-inch cellulose-filled TJI panels strapped with a smart vapor barrier on the interior side and a vented channel above the weather barrier and roof sheathing. The overhangs are integrated with the panels, minimizing thermal bridging.

The owners revere fireplaces, so a wood-fired, sealed-combustion stove was installed in the living room. All the other appliances are electric, including the ERV and an air source heat pump for heating and cooling, which has two zones. A PV array on the site allows for the possibility of the house being net zero energy on an annual basis.

Products

Air/Moisture Control

[Pro Clima from 475](#)

[ZIP System Sheathing and Tape](#)

Photos by Barry Price

Passive House Metrics

Specific space heating demand	6.7 kBtu/ft ² /yr	21.3 kWh/m ² /yr
Specific space cooling demand	7.7 kBtu/ft ² /yr	24.3 kWh/m ² /yr
Source energy use intensity (EUI)	46.6 kBtu/ft ² /yr	147.1 kWh/m ² /yr
Source energy use intensity (EUI) (renewable)	23.2 kBtu/ft ² /yr	73.2 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀	



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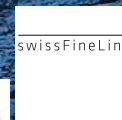
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Fox HALL

Ancram, New York

Convincing a client to build a Passive House can be easy with the right client. The Fox Hall project started with a client who was very interested in energy conservation, sustainability, recycling, and having a retreat outside of New York City where he could charge his Tesla with solar power. A few years later, he ended up with two buildings.

The first is a 3,400-ft² timber-framed barn that was deconstructed and moved from a village about 30 miles away. During reconstruction, a 700-ft² Passive House-inspired apartment was built into the lower floor of the barn. The owner used that apartment while the second building, a new 2,136-ft² Certified Passive House, was being built. The relocated barn inspired the house's design, a timber-

Team

Architect

[BarlisWedlick Architects](#)

Builder

[Bill Stratton Building Company](#)

Certified Passive House Consultant

[The Levy Partnership](#)

Structural Engineer

[Crawford & Associates Engineering, P.C.](#)



framed structure wrapped in structural industrial panels (SIPs). Additional structures include a green-roofed garage and a sauna below an elevated screened-in porch accessible from the house via an elevated bridge.

BarlisWedlick Architects was no stranger to SIP-wrapped, timber-framed buildings. It had used this approach on a previous project and has used it since the completion of this project. The construction method simplifies many things. First, the air and thermal barriers are isolated from the rest of





the building and totally aligned in a single assembly. This simplifies construction detailing, making it easy to communicate the Passive House shell requirements to the builder and trades. Second, the air barrier is simply the interior SIP OSB surface with taped seams—with no additional materials or detailing needed. A secondary interior utility chase eliminates the need to penetrate the SIPs.

The main house is outfitted with a monitoring system that includes humidity sensing. This feature showed the team that winter humidity levels were abnormally



low. The team attributed this to the fact that the owner does not live there. Less than full-time occupancy generates less indoor humidity. Instead of switching the installed HRV to an ERV, the team added more humidification, a less-expensive solution.

This project was featured in the 2016 Interiors issue of *Dwell* magazine. While he is proud of the attention given to his firm's interior design practice, architect Alan Barlis is pleased that the focus of the magazine article wasn't its Passive House credentials. When Passive House is no longer the primary story but a secondary one, he believes that signals a welcome turning point: Passive Houses are becoming an accepted and typical part of any discussion about building in general.

Products

Ventilation

Zehnder America

Heating & Cooling

Fujitsu

Photos by Reto Guntli

Passive House Metrics

Specific space heating demand	3.2 kBtu/ft ² /yr	10 kWh/m ² /yr
Specific space cooling demand	2.5 kBtu/ft ² /yr	8 kWh/m ² /yr
Source energy use intensity (EUI)	36.1 kBtu/ft ² /yr	114 kWh/m ² /yr
Air changes per hour	0.38 ACH ₅₀	



KING + KING

The Stone Schoolhouse Passive House is an almost perfect case of the past and present fusing to create a yet-more-perfect form. Interestingly, the building and the architectural firm undertaking the retrofit have similar roots, with histories that date back to the nineteenth century.

The schoolhouse was built in 1849. The architectural firm spearheading the building's renovation, King + King, located in Syracuse, has been around almost as long. Founded in 1868, it's one of the oldest architectural practices in the country. King family members have been involved in the practice from nearly the beginning, going back five generations. The firm is known primarily for nonresidential buildings, especially education and health care facilities.

Now Passive House is changing both the building's and the firm's trajectories. The project manager, Tom King, is the son of Jim King, one of the firm's partners. The younger King recently graduated from Stevens Institute of Technology with a master's degree in product architecture and engineering, complementing his undergraduate architecture degree. The focus of King's Stevens curriculum was to prepare an entry for the 2015 U.S. Department of Energy Solar Decathlon competition. One of the courses focused on Passive House



principles, enabling King to sit for and pass the Certified Passive House Designer and Tradesperson exams. His team's Passive House-designed SURE HOUSE won the Decathlon in seven out of ten categories, and took the overall prize.

After graduation, Tom joined King + King, bringing with him his interest in Passive House technologies. The Stone Schoolhouse is the firm's first Passive House project, although due to the structure's historic tendencies and interior insulation strategy, it will need to comply with certain exemptions of EnerPHit to become eligible for certification. The schoolhouse is being converted into a residence for King's parents, who are downsizing from a 3,000-ft² home. As the Schoolhouse comes to completion, King continues to incorporate Passive House principles into the firm's larger commercial and institutional projects.

Once the project is finished, the new generation will have successfully picked up the architectural torch from the previous generation, and in return, will have provided them with a comfortable and efficient twenty-first-century home. Seems like a fair exchange.

Photos courtesy of King + King Architects

Stone SCHOOLHOUSE

Fayetteville, New York

This 800-ft² schoolhouse, empty for the last 20 years, was built in 1849 in Fayetteville, New York, a small village near Syracuse. Its renovation required that the building retain its historical character, which is defined primarily by the 22-inch-thick structural limestone walls. For that reason, all insulation and air sealing had to be done from the inside. In addition, the changes couldn't compromise the integrity of the walls. Structural stone is susceptible to vapor drive and damage from freeze-thaw cycles. The project team ran extensive hygrothermal analyses to make sure that once insulated, the walls would continue to perform and withstand 150 more years of use.

Passive House guidelines suggest that in a climate zone like Fayetteville, stone houses should generally be less insulated, especially on the interior, than typical

Passive Houses. The Schoolhouse walls have a total of 7.5 inches of mineral fiber insulation on the interior (R-31.5), with 3.5 inches against the stone, and another 3.5 inches in a 2 x 4 wall detached from the stone, creating a thermal-bridge-free assembly. The insulated crawl space has 4 inches of fiberboard (R-16) on grade and 7.5 inches on the walls.

The roof assembly relies on exterior insulation. The heavy timber roof framing and interior sheathing are left exposed for historical accuracy and aesthetics. To allow for a continuous thermal assembly, the roof was raised 7 inches, and high-density structural glass insulation was inserted between the roof frame and the top of the stone walls. Another 6.3 inches of phenolic insulating foam (R-53) is layered above the sheathing.

The thermal barrier goes from inside on the crawl space floor and walls to outside on the roof. The air barrier wraps from the crawl space vapor barrier up the interior stone wall surface, over the top of the wall to the outside, and to the roof sheathing under the phenolic-foam insulation.

Team

Architect

King + King Architects

Builder

B. Vincent Contracting

Electrical

H2flo Plumbing

Certified Passive House Consultant

Tom King



Humidity control is essential to the project's success. The ERV has an 87% heat recovery and a 40%+ humidity recovery rate. The all-electric house will include an induction cooktop, and an air source mini-split heat pump for heating and cooling. Waste heat from showering will be recovered and circulated back to a 50-gallon heat pump water heater.

The project team plans to monitor temperature and humidity within the thermal layers after occupancy to ensure that the retrofit is not damaging the existing structure by means of condensation within the wall cavity. It will also track electric use through the first year to size a PV array for a net zero profile. In phase two, the solar hardware will be mounted on a newly constructed detached vehicle shed roof.

Products

Windows & Doors

[Makrowin by European Architectural Supply](#)

Ventilation

[UltimateAir](#)

Insulation

[Rockwool](#)

Photos courtesy of King + King Architects

Passive House Metrics

Specific space heating demand	15.52 kBtu/ft ² /yr	49 kWh/m ² /yr
Specific space cooling demand	9.45 kBtu/ft ² /yr	30 kWh/m ² /yr
Source energy use intensity (EUI)	82.8 kBtu/ft ² /yr	261 kWh/m ² /yr
Air changes per hour	0.73 ACH ₅₀	



Passive House VACATION Rental

Philmont, New York

When planning the transformation of his modest 1960s-era home, a home that had burned through the heating oil each winter, architect Thomas Paino had an overriding vision—a four-bedroom, extremely comfortable vacation rental with a tiny utility bill. Having already completed one Passive House retrofit, he was familiar with the strategies needed to achieve his net zero energy goal.



“The shape of the house was an advantage,” says Paino, referring to its simple, rectangular form. Preserving this advantage, Paino built up from the existing exterior walls, adding a second story and bringing the interior floor area to 2,200 square feet. A new garage and stair tower on the north side of the building are outside of the envelope.

The existing wall construction created a somewhat tricky complication, says Paino, because the walls were built using 2 x 4s. Adding another floor required beefing up that structure, so he opted for a second 2 x 4 wall inboard of the existing one,

Team

Architect
[Thomas Paino](#)

**Energy, Thermal,
and HERS Consultant**
[Integral Building & Design](#)

Solar Consultant
[Lighthouse Solar](#)

and the second floor was constructed similarly. All of the exterior walls are clad warmly in three layers of insulation, with 2 inches of XPS on the exterior, blown-in cellulose in the first 2 x 4 wall, and rock wool insulation on the inner one. The attic holds 18 inches of cellulose.

The old house had moisture issues in the basement, due primarily to the lack of a drainage system around the house. Excavating around the foundation provided the access to install both a French drain system and 2 inches of rigid mineral wool exterior insulation. There was no reason to dig up the slab, so Paino had sturdy, high-R-value interlocking panels installed on top of the basement slab.

The builder came up with a novel approach to creating a seamless air barrier. After installing the air barrier membrane on the first floor, he left hanging enough membrane to cover the second-floor walls, securing the membrane once those were built. The strategy was very successful, with the final blower door test result for this retrofit falling at a snug 0.59 ACH₅₀.

An ERV and a ducted mini-split will keep the air fresh and the house comfortable year-round. Each floor will have an air-handling unit, and the condenser will sit discreetly on the independently supported, 4-foot-wide second-floor deck. A heat pump water heater with an 80-gallon tank will supply the vacationers with plenty of hot water.

Two mature maple trees, one off the southwest corner and one on the east, provide summertime shading and add graceful notes to the property. The home is well suited for families or groups seeking retreats in nature or a special-event locale.



Photos by Wheeler Drone (top left) and Thomas Paino (bottom left and top right)

Products

Windows & Doors
[Schuco by European Architectural Supply](#)

Air/Moisture Control
[Pro Clima from 475](#)

Insulation
[InSoFast](#)

[Rockwool](#)

Passive House Metrics

Specific space heating demand	4.7 kBtu/ft ² /yr	14.8 kWh/m ² /yr
Specific space cooling demand	2.6 kBtu/ft ² /yr	8.2 kWh/m ² /yr
Source energy use intensity (EUI)	32.1 kBtu/ft ² /yr	101.2 kWh/m ² /yr
Air changes per hour	0.59 ACH ₅₀	

CONTEMPORARY Net Zero

Hillsdale, New York

Set in the hills of upstate New York, this contemporary two-story Passive House features wall assemblies constructed of fire-resistant, water-resistant autoclaved aerated concrete (AAC) blocks—a first in North America. AAC is a lightweight concrete product that was invented in Sweden in the 1920s. The homeowner, Steven Bluestone, has extensive development experience and rebuilt three other residential properties on Staten Island using AAC, after the original homes were destroyed by Superstorm Sandy.

When Bluestone and his wife found the property that would ultimately be the site for their own home, they fell in love with the extensive south-facing views that its location affords. “On a good day you can see 25 miles or more to the south and 35 miles out toward the Catskills located on the other side of the Hudson River,” says Bluestone. The north-facing entry foyer seamlessly steps to a south-facing great room—kitchen and living and dining rooms—that takes full advantage of these views with ample triple-pane, Passive House-quality glazing. The house is designed for aging in place, with the master bedroom suite and laundry room on the same main level as the great room. Downstairs are a large guest bedroom, an office, and a recreation room.

Team

Builder-Owner
[Steven Bluestone](#)

Architect
[Bruce Coldham](#)

**Certified Passive House
Consultant**
[Jordan Dentz](#)



Keeping the house snug, the AAC blocks serve as the air barrier in the wall assemblies, which are plastered on the interior. Exterior to the blocks are 4½ inches of polyiso insulation and fiber cement siding. Architect Bruce Coldham and Bluestone had to devise a board-and-batten system to attach these components, starting with pressure-treated 2 x 4s that were glued and screwed vertically to the AAC. These 2 x 4s were fastened on every 24 inches, and sheets of EPS insulation were fitted in between. Another 3-inch layer of insulation was overlaid on the first, secured by 1 x 4s that were attached to the 2 x 4s with long structural screws. To ensure no deflection, longer 1 x 4s were secured to the framing in the overhang above. The fiber cement siding hangs off of the 1 x 4s.

This draft-free house is comfortable in all seasons, even though the family set the thermostat at a slightly low 65°F or 66 °F in winter. “I feel fine walking around in short sleeves,” says Bluestone.

Concerned about climate change, Bluestone had initially targeted net zero energy use as a goal for the all-electric house, installing a 9.6-kW PV system. He has not only met but exceeded his goal—producing more energy than the family uses on an annual basis.



Products

Windows & Doors
[Zola](#)

Ventilation
[Zehnder America](#)

**Drain Water Heat
Recovery**
[RenewABILITY Energy Inc](#)

Photos by Steven Bluestone

Passive House Metrics

Specific space heating demand	7.2 kBtu/ft ² /yr	22.6 kWh/m ² /yr
Specific space cooling demand	0.11 kBtu/ft ² /yr	0.4 kWh/m ² /yr
Source energy use intensity (EUI)	20,326 kBtu/person/yr	5,957 kWh/person/yr
Air changes per hour	0.05 CFM/ft ²	



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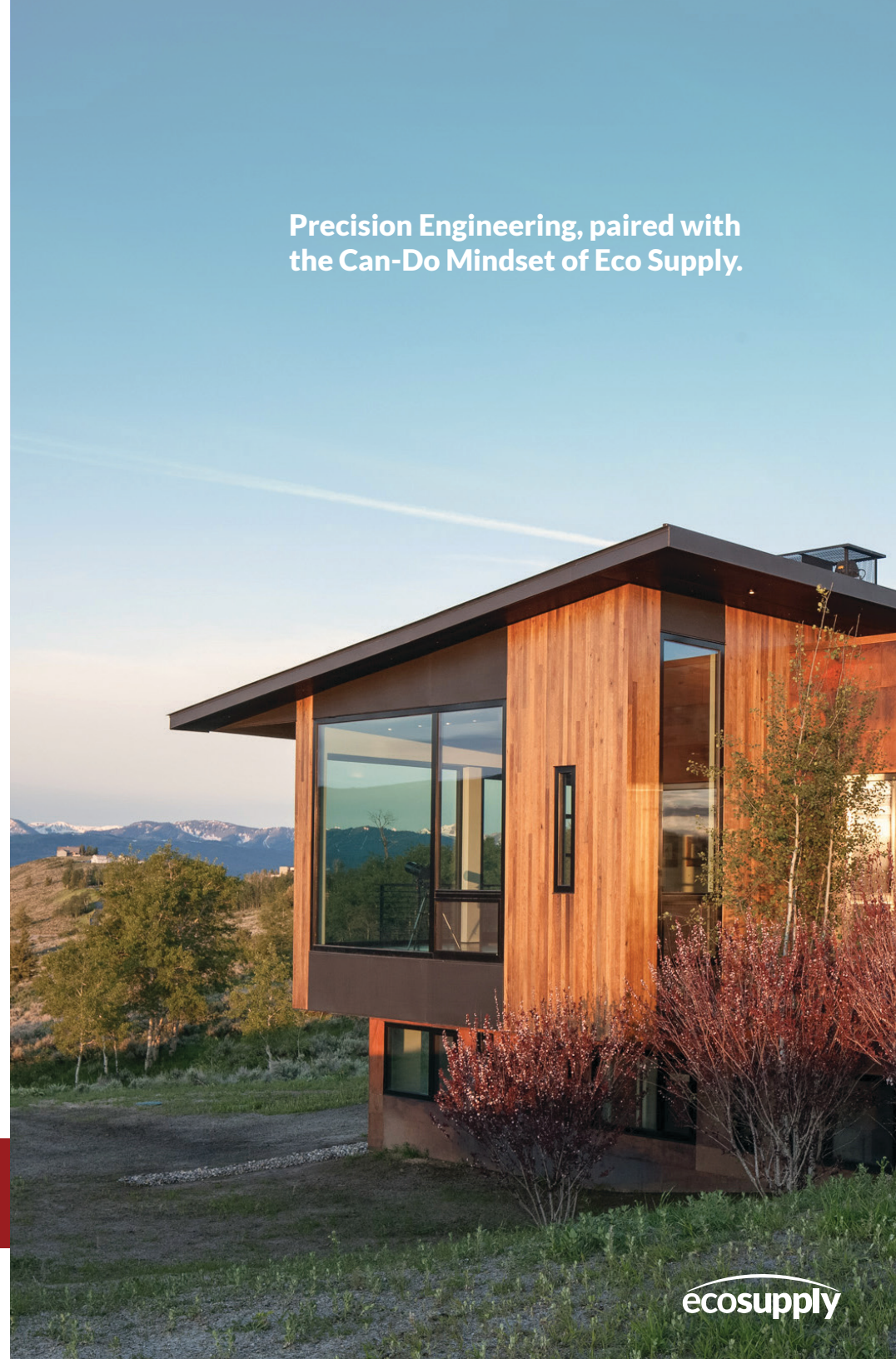
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ACCORD Passive House

Accord, New York

Designed by North River Architecture & Planning senior designer Peter Reynolds and principal Stephanie Bassler, the Accord Passive House is also Reynolds's home. Reflecting the region's barn vernacular architecture, the house has a 1,656-ft² finished first floor, and a 1,099-ft² unfinished second floor suitable for adding two more bedrooms and a bathroom.

The firm approached this project as a test case for a few key concepts concerning the viability of Passive House construction for single-family residential projects in its Hudson Valley region, located about 100 miles north of New York City. Most importantly, the firm feels that Passive Houses should be affordable for the broadest possible market. To achieve this, the firm wished to show that a Passive House should be designed in such a way that any competent builder should be able to construct it. North River also thinks that in order for Passive Houses to be understood as feasible and affordable, the firm's project stories, successes, and challenges should be shared with peer networks.

With Reynolds as owner/builder and general contractor, North River was able to complete this house for approximately \$220 per square foot, including energy

Team

Architect

[North River Architecture & Planning](#)

Structural Engineer

[Kaaterskill Associates](#)

Mechanical Consultant

[Baukraft Engineering](#)

Certified Passive House/ WUFI Consultant

Northeast Projects, LLC

PHIUS Rater

Spruce Mountain, Incorporated

modeling, certification, and site costs. This figure, less than the cost of a typical custom home in the region, includes a generous allowance to represent added costs if a general contractor were hired to build the project.

The firm worked with subcontractors who had never before built a Passive House. According to Bassler, it didn't scour the region for high-end contractors. On the contrary, many of the subcontractors were trustworthy low bidders, which helped them achieve the project's affordability goal. No special training was provided, although the firm did spend some extra time explaining specifics like air barrier and window installation details. As the homeowner, Reynolds also spent quite a bit of time on site as a quality assurance inspector. This time was factored into the budget, as the firm takes this hands-on approach with all its clients' projects.

One other area of focus for the firm is net zero construction. This house includes a 9-kW PV system that is sized to produce as much power annually as the household will consume, with enough additional power to charge the Reynolds's electric car. The system cost of \$10,000, after tax credits and local utility rebates, is included in the \$220 per square foot budget.



Photos by Deborah DeGraffenreid Photography

Passive House Metrics

Specific space heating demand	5.8 kBtu/ft ² /yr	18.1 kWh/m ² /yr
Specific space cooling demand	0.96 kBtu/ft ² /yr	3.0 kWh/m ² /yr
Source energy use intensity (EUI)	20.2 kBtu/ft ² /yr	63.7 kWh/m ² /yr
Air changes per hour	0.04 CFM ₅₀ /ft ² (design)	



Products

Windows & Doors

[Zola](#)

Air/Moisture Control

[Siga](#)

[ZIP System Sheathing and Tape](#)

Heating & Cooling

[Fujitsu](#)

For the most part, using trades inexperienced in Passive House construction posed no significant construction challenges. Setting the insulated foundation form block system for the shallow frost-protected slab foundation on a sloped site was the trickiest part of the entire process, according to Reynolds. With this first install under its belt, North River intends to keep using these same building systems as it proceeds, refining the process with each new project, and educating its clients and peer networks along the way.

Simplicity SUCCEEDS

Wurtsboro, New York

Certified Passive House Consultant and long-time energy rater Troy Hodas has been around the high-performance building block more than a few times. When it came to designing and building his own family's home, he was excited to be implementing the best takeaways from homes he had rated, and he definitely wanted a Passive House. "I was drawn to Passive House for the level of performance it delivers as well as the durability and comfort," says Hodas.

Hodas and his wife, Ania, started their design journey with the principle of keeping the house simple and right sized. "We wanted to have the space we need and not add a ton of extra square footage," he explains. The roughly 1,500-ft² home meets those goals, and its reasonable size translated into a right-sized mortgage. The home has two bedrooms, two baths, office space, and an open-floor-plan kitchen, dining, and living room. There is also a full basement that is thermally protected.

Team

Designer, Builder, and Certified Passive House Consultant

Spruce Mountain, Incorporated
troyhodas@gmail.com

Engineer

Paul Mele



Wanting to be involved with his home's construction, Hodas chose to build with ICFs, which he installed with help from a few friends. The ICF product he selected had an additional 2-inch insert of a graphite-enhanced EPS to deliver R-36 walls. The attic achieves an R-70 using 18 to 20 inches of loose-fill cellulose. Two 2-inch layers of XPS separate the slab from the ground.

Although the home is in New York's coldest climate zone, it is heated with just one 9-kBtu hyperheat wall-mounted mini-split on the first floor. An ERV distributes heat and provides fresh air for ventilation. A friend installed temperature sensors throughout the home for a research presentation he was giving on high-performance homes. With just the point source mini-split and ERV, even when arctic freezes were descending on Hodas and his family, the largest room-to-room temperature difference was only 4°F. In summer they mostly run the heat pump on dry mode if at all. It provides dehumidification, keeping them comfortable—although they are admittedly used to tolerating some summertime discomfort, as they didn't have any air-conditioning in their old home.

Hodas installed a 6.72-kW PV system on this all-electric house, leaving his family with monthly utility bills of just the minimum delivery fee and a refund check for the roughly 800 kWh of overproduction. Like any good energy nerd, he totaled up the energy used in the home for heating and hot water and figured they used the equivalent of 61 gallons of heating oil for the full year. In his old house, he filled up his 275-gallon tank at least twice annually. "What the majority don't understand," says Hodas, "is that besides all the other great benefits of building this way, it's also a good investment. There isn't much else out there with as good and as stable an ROI."

Products

Air/Moisture Control
Pro Clima from 475

Siga

Ventilation
UltimateAir

Heating & Cooling
Fujitsu

Photos by Troy Hodas

Passive House Metrics

Specific space heating demand	6.5 kBtu/ft ² /yr	20.5 kWh/m ² /yr
Specific space cooling demand	1.2 kBtu/ft ² /yr	3.7 kWh/m ² /yr
Site energy use	16,409 kBtu/yr	4,809 kWh/yr
Air changes per hour	0.6 ACH ₅₀	



WOODSTOCK Passive House

Woodstock, New York

Dan Levy, certified Passive House consultant (CPHC) and president of Greenspring Building Systems, is a passionate advocate of autoclaved aerated concrete (AAC). The combination of Passive House design principles and AAC, Levy says, could well be a serious solution to help mitigate climate change.

AAC is composed of sand, gypsum, lime, cement, and a trace of aluminum powder. During manufacturing, a chemical reaction takes place that entraps air bubbles in the resulting masonry units. AAC weighs 80% less than concrete but retains approximately 20% of concrete's compressive strength. It has an insulation value of roughly R-1 per inch and provides both an air and a bulk water barrier. Additional characteristics include a four-hour fire rating and pest and mold resistance. (Because they are built with products that do not support mold, or outgas, Levy's buildings are ideal for people with chemical sensitivities.) A properly built AAC building should last for centuries.

The Woodstock Passive House, Levy's first certified home, is a 2,373-ft², two-story single-family home, with an accessible first-floor bedroom plus a 576-ft² garage with an upstairs apartment. The foundation footings are wrapped in 10 inches of cellular glass. The 4-inch concrete slab also has 10 inches of cellular glass underneath for a floor R-value of 34. The walls are 8 inches of AAC plus 6 inches of mineral wool, finished with plaster and siding, for a composite R-value of 34. The roof assembly was built using scissor trusses with raised heels, allowing for 24 inches of blown-in cellulose for an R-value of 86. Although the wall insulation

Team

Architect and Certified Passive House Consultant

Gal Gabriel

Builder and Certified Passive House Consultant

[Greenspring Building Systems, Inc.](#)

HVAC

All Season Experts



is somewhat lower than is recommended for a Passive House in climate zone 6, the floor and roof values are somewhat higher, mitigating the walls' shortfall.

Both all-electric units have identical mechanical systems: heat pump water heaters, 9,000-Btu mini-splits with one head per floor, ERVs, and electric kitchen appliances, including induction cooktops. Clothes drying is done with a ductless heat pump dryer. The electric consumption is offset by a 7.6-kW PV system on the roof of the main house.

Levy is convinced that AAC provides by far the easiest way to build an energy-efficient and durable building. As he points out, Passive Houses are first and foremost about energy efficiency and comfort, but durability is equally important. An AAC building requires very little shell maintenance, and it has no effective change in infiltration over decades, perhaps centuries.

Photos by Daniel A. Levy

Passive House Metrics

Specific space heating demand	5.9 kBtu/ft ² /yr	18.8 kWh/m ² /yr
Specific space cooling demand	4.6 kBtu/ft ² /yr	14.5 kWh/m ² /yr
Source energy use intensity (EUI)	25.1 kBtu/ft ² /yr	79.2 kWh/m ² /yr
Air changes per hour	0.49 ACH ₅₀	

Products

Ventilation

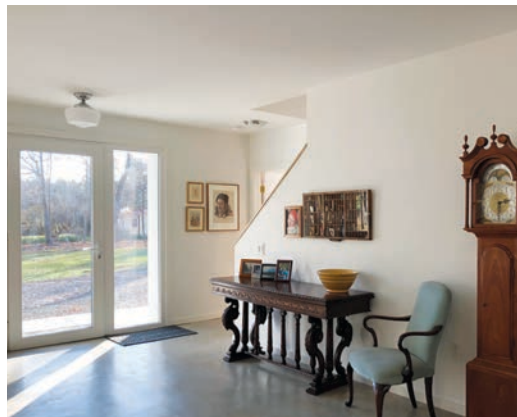
[UltimateAir](#)

Insulation

[Rockwool](#)

Heating & Cooling

[Fujitsu](#)





COLONIAL Farmhouse

Honeoye Falls, New York

“We look out the windows at the snow blowing, and it’s like we are watching it on TV,” says Matt Bowers, principal of Rochester Passive House Consulting and the happy occupant with his family of the Colonial Farmhouse. Completed in 2016, the incredibly comfortable two-story, three-bedroom Passive House is performing even better than expected.

Bowers, a Passive House and energy consultant, as well as a blower door trainer, has been keeping a close eye on the home’s monitored energy data. In its first year of operation, the almost 3,000-ft² home cost \$41 to cool and less than \$200 to heat. These very modest heating and cooling bills bear out Bowers’s early calculations that the cost premium for building a Passive House, rolled into his mortgage, would be balanced out by his energy cost savings. As he points out, his experience refutes the misperception that Passive House is expensive.

The home’s traditional farmhouse aesthetic cloaks a 16-inch double-wall assembly that is insulated with dense-packed cellulose, achieving an R-55. The interior load-bearing 2 x 4 wall acts as a service cavity. A carefully sealed OSB layer

Team

Passive House Consulting
Rochester Passive House
Consulting

Energy Services
Airtight Services, Incorporated

Construction
Garbacik Construction,
Incorporated
—tadgarbacik@gmail.com

Architect
Grater Architects, P.C.
graterarchitects.com

exterior side of the double-wall assembly guard against moisture intrusion.

The 24-inch foundation wall was constructed using an ICF block and a 2 x 4 wall separated by 8 inches of cellulose insulation, achieving a total R-value of 63. Eight inches of EPS lie under and at the perimeter of the 4-inch slab. The raised-heel truss roof assembly holds 24 inches of blown-in cellulose.

Because icy winds blow down periodically from nearby Lake Ontario, a 200-foot subsoil brine loop was installed to temper the air arriving at the HRV; in summer the loop pre-cools the incoming fresh air. Two ductless mini-split heat pumps deliver the heating in winter. In summer, they are used mostly for dehumidification, for the times when temperatures don’t exceed 80°F but humidity hits 85%.

Although last winter was a bit mild by Rochester standards, this very energy-efficient house achieves remarkable comfort even on the more extreme days. Bowers jokes that he has to hand out T-shirts on Christmas when family gatherings bring in more than enough body heat to compensate for the cold winds blowing outdoors—which are only noticeable by looking out through the triple-pane windows and watching the tree branches sway.



Photos courtesy of Matthew Bowers

Products

Windows & Doors
Zola

Air/Moisture Control
ZIP System Sheathing
and Tape

Water Heating
Sanden

Drain Water Heat Recovery
[RenewABILITY Energy Inc](http://RenewABILITYEnergyInc.com)

Passive House Metrics

Specific space heating demand	4.7 kBtu/ft ² /yr	14.7 kWh/m ² /yr
Specific space cooling demand	0.4 kBtu/ft ² /yr	1.3 kWh/m ² /yr
Source energy use intensity (EUI)	28.6 kBtu/ft ² /yr	90.2 kWh/m ² /yr
Air changes per hour	0.1 ACH ₅₀	

OWNER-BUILDER Goes for *Passive*

Honeoye Falls, New York

Jason DiPietro developed an appreciation for owner-built homes early in life, having watched his father build their family's home not once, but twice. Inspired, DiPietro was determined to one day build "the very best house I could build." Having researched several building methodologies, he found that the science-based approach of Passive House instantly resonated with him. After locating a prime piece of land and designing his dream house, he left nothing to chance, assigning himself the role of general contractor. He then turned to his original inspiration for support—his 68-year-old father—who was on his team from day one.

When choosing wall assemblies and other details, DiPietro relied on the advice extended by Passive House professionals. "The Passive House community was not only passionate and technically minded, but very forthcoming with details and information," he says.

Weighing Passive House's technical specifications against his own desire for a water view, DiPietro took one side step from Passive House logic—opting for large

Team

Builder

DiPietro Builders
—jason.dipietro@gmail.com

Architect

Marathon Engineering

Certified Passive House Consultant

[Rochester Passive House Consulting, LLC](#)



windows overlooking the pond on the north side of his property. But DiPietro planned compensations. The master bedroom's floor-to-ceiling glass is a triple-paned

uPVC window, complemented by a similarly Passive House-rated glass door. This door opens onto a deck with stunning views of the pond. Matching lower-floor counterparts in the kitchen and basement both give access to the yard. DiPietro further adjusted for the heat loss by superinsulating and air sealing.

The build began with a superinsulated basement slab and walls; reclaimed EPS foam helped with both cost and environmental impact. The above-grade walls consist of R-50 double-stud wall assemblies with a 2 x 6 load-bearing exterior wall and a 2 x 4 interior wall, 24 inches on center. DiPietro used proprietary sheathing as the primary air barrier and 4 inches of closed-cell spray foam, applied continuously to the back of the sheathing. Eight inches of dense-packed cellulose fill the cavity between the interior and exterior walls. The closed-cell foam was sourced from Canada and uses a fourth-generation blowing agent that has a global warming potential of 1. To reduce maintenance, DiPietro chose vinyl siding and PVC trim. The roof assembly is filled with enough blown-in cellulose to deliver an R-value of 90.

Because Passive House requires such attention to detail, DiPietro remained vigilant throughout the build. "Most contractors that come in are very excited to hear about all the details," he says, "but are less than enthusiastic about mastering air sealing themselves." The final blower door test came in at a very snug 0.19 ACH₅₀. His dream home will offer both exceptional comfort and very low energy consumption over the years—a true labor of love that he says was worth all of the effort.

Products

Windows & Doors

[Zola](#)

Ventilation

[Zehnder America](#)

Photos by Jason DiPietro

Passive House Metrics

Specific space heating demand	6.5 kBtu/ft ² /yr	20.4 kWh/m ² /yr
Specific space cooling demand	2.5 kBtu/ft ² /yr	7.8 kWh/m ² /yr
Source energy use intensity (EUI)	28.4 kBtu/ft ² /yr	89.5 kWh/m ² /yr
Air changes per hour	0.19 ACH ₅₀	





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a.m. BENZING architects, pllc

Andreas Benzing, principal of a.m. Benzing architects, pllc in New York City, jumped early into Passive House design. He took the consultant training in 2009 and tackled his first PassiveHouse retrofit in 2010. Ever since, it's been practically another year, another Passive House. Benzing also teaches architecture and energy courses at Parsons School of Design and serves as president of the board of New York Passive House.

Benzing's nearly ten years of experience, starting with the retrofit of a 1925 beach cottage on Long Island, has had its payoffs. Researching which wall system will work most effectively in a given Passive House building can be time consuming; but with each succeeding project, that research time diminishes. Passive House construction generally follows a similar arc, with the first project being the most arduous—assuming the team members don't change. For the gut renovation and expansion of the cottage, Benzing was fortunate to work with the Taorminas, a father-and-son contracting team who were open to receiving a hands-on education in implementing Passive House details. Benzing has partnered with this contracting team in each of his subsequent Passive House projects, streamlining the communications and overall construction process.

Benzing's next retrofit project, in Mamaroneck, New York, transformed a 1960s-era split-level bungalow into an efficient, comfortable, and beautiful home. The existing first floor was stripped to its studs and rebuilt with additional layers of insulation, and a second story was added. Combining beauty and functionality, a redwood pergola shades the ground-floor windows on the south side in the summer, while a 2-foot roof overhang shades the south-facing upstairs windows. The home feels gracious and airy, its airtight Passive House construction a subtle feature.

Benzing is currently overseeing the construction of a new, roughly 5,000-ft² home that he designed. The client wanted an architect with Passive House experience, found photos of the Mamaroneck home, and called Benzing. This foam-free Passive House has a fairly traditional look from the exterior, partly to please Scarsdale's conservative-minded architectural review board. Inside it opens up to a modern interior with an open-floor plan. The three-bedroom home includes generous office space, a full cellar, and an elevator.

The south, east, and west façades, which are visible from the street, are faced in brick, with 3 inches of rock wool insulation beneath it. The back façade has 6 inches of insulation beneath a fiber cement siding. The site is quite rocky, which made installing insulation under the footings too challenging and costly to contemplate. Instead, the full basement is insulated on the interior with rock wool. Cavity walls downstairs and up are insulated with dense-packed cellulose.

Benzing's solid grounding in Passive House principles allows the design process to flow smoothly. "It is easier for me to come up with a design, because I don't have to think as much about the technical aspects," he notes. New construction is still always easier than Passive House renovations, but in either case the end result is remarkable, and much better than conventional construction can deliver.



Photo by a.m. Benzing architects

Resiliency and Market APPEAL

Freeport, Long Island

Inspired partly by the devastation wreaked by Superstorm Sandy, architect Andreas Benzing designed and developed a spec single-family home in a flood zone in Freeport, Long Island. Introduced to the market in May 2017, the three-bedroom, three-bath home had sold by June.

The home's Passive House features work synergistically to facilitate its flood resistance and overall resiliency. By sharply cutting the heating demand, Benzing eradicated the need for a gas furnace, instead creating a home that could be kept comfortable year-round using a mini-split heat pump and an ERV. The house is all electric, with a heat pump water heater supplying the hot water.

This equipment is stored on the second floor, leaving the flood-resistant ground floor to house the garage. To further floodproof the home, the ground floor consists of two rotated U-shapes with an open center, so surging waters can have a clear exit path and the structure won't be fighting against the flood. The living space starts at 14 feet above the mean level of the ocean.

The building's overall form resembles a saltbox, tweaked to provide maximum wind resistance. The prevailing winds are from the southwest, so this side has only one floor above the garage and a thick, protecting roof angled to take the brunt of the winds. The east-facing side rises to two stories, affording generous water views through the triple-pane windows.

The exterior wall assembly features double 2 x 6 walls with the outer one bolted to the rough framing, which in turn is connected with hurricane-rated clips to the concrete foundation supporting the house. The structural

Team

Architect

[a.m. Benzing architects, pllc](#)

Builder

[North Shore Construction Services, Incorporated](#)



sheathing between the two framed walls serves as the combined air barrier and vapor retarder. The exterior cladding was installed over a vented rain screen gap to prevent water intrusion.

Benzing designed the roughly 1,750-ft² home to meet the Passive House Institute's Low Energy Building class, as the other classes would have required more insulation in the walls, eating into more of the usable floor area. As it is, the home's thicker-than-typical walls reduced the house's square footage by 140 square feet—well worth it for the superior comfort.

The feedback from the family of four that bought the home is all positive. With their consent, Benzing installed an energy monitor and is checking the accumulated energy data. So far he has only four months of data, and there have been no surprises—just predictable comfort with predictably low energy usage.

Products

Air/Moisture Control

[Pro Clima from 475](#)

Insulation

[Rockwool](#)



Photos by *a.m. Benzing architects*

Passive House Metrics

Specific space heating demand	9.1 kBtu/ft ² /yr	28.7 kWh/m ² /yr
Specific space cooling demand	7.7 kBtu/ft ² /yr	24.3 kWh/m ² /yr
Source energy use intensity (EUI)	38.0 kBtu/ft ² /yr	119.9 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀	



Mamaroneck ENERPHIT House

Mamaroneck, New York

The owners of what had been a 60s-era split-level bungalow were clear about their goal from the beginning; they wanted a beautiful makeover and the kind of comfort that only a Passive House retrofit, or EnerPHit home, could bring. Carefully planned, every detail in this retrofit contributed to that goal.

Reusing what was still in good shape, the foundation and basement were retained. The roof was removed, and a second story was added. The first floor walls were taken down to the studs, which were then wrapped with OSB sheathing and 5 inches of graphite-infused EPS. The new roof's 2x12 joists are surrounded by dense-pack cellulose with a 1½-inch layer of EPS on the exterior.

The cladding is fiber-cement siding with redwood trim work and custom-built redwood shutters on the west side. These moveable shutters provide protection from storms. A redwood pergola shades the ground-floor windows on the south

Team

Architect and Passive House Consulting

[a.m. Benzing architects, pllc](#)

Craftsperson

[North Shore Construction Services INC.](#)



side in the summer, while a two-foot roof overhang shades the south-facing upstairs windows.

Heating and cooling are provided by a ductless mini-split heat pump with four wall-hung units, aided by an energy-recovery ventilator. With Hurricane Sandy a too-vivid memory, the owners chose to install a backup natural gas-powered stove, which can put out 18,000 Btu/hr. A

6.7-kW photovoltaic (PV) system mounted on the roof is expected to make the house net-zero in electric energy use on an annual basis.

The rebuilt home has an open, airy feel with multiple decks that face the private dock and the waterfront. It's a showcase of what an EnerPHit can achieve.

Photos by Korin Krossber for PlanOmatic



Products

Air/Moisture Control
[ZIP System Sheathing and Tape](#)

Ventilation
[Zehnder America](#)

Passive House Metrics

Specific space heating demand	6.8 kBtu/ft ² /yr	21.5 kWh/m ² /yr
Specific space cooling demand	6.5 kBtu/ft ² /yr	20.5 kWh/m ² /yr
Source energy use intensity (EUI)	37.0 kBtu/ft ² /yr	116.7 kWh/m ² /yr
Air changes per hour	0.7 ACH ₅₀	



BUCK MOORHEAD

Architect

Manhattan-based Buck Moorhead Architect (BMA) strives to incorporate Passive House strategies in all of its projects both seamlessly and automatically, helping clients achieve their program goals without necessarily calling the client's attention to energy conservation or climate change mitigation. As an architect, Moorhead prioritizes designing buildings that will stand up and keep the rain out, while also treating Passive House and other sustainable practices as givens. Moorhead tells clients, "Your building will be comfortable, with a healthy indoor air quality, quiet, durable, and resilient, and will require very little energy."

BMA also designs overtly to Passive House standards when requested. The firm designed a Habitat for Humanity four-bedroom house as a new build, where the Habitat chapter specifically wanted to meet Passive House standards.

For both new builds and retrofits, BMA's goal is to achieve Passive House-level performance targets. When a direct route to that goal is not available for a project, it encourages design decisions that achieve the goal one step at a time. To that end, the firm avoids locking in incomplete details that may compromise a next-phase renovation. It also encourages clients to direct funds in the project budget strategically, to focus on implementing Passive House principles. At the same time, the firm emphasizes to clients the benefits to be derived from implementing these principles—benefits that include increased durability, enhanced indoor air quality, lower energy bills, and as a bonus, the mitigation of climate change.

A case in point is the Western Sullivan Public Library in Jeffersonville, New York. Contacted to consult on a cosmetic interior renovation, BMA discovered that the existing dropped ceiling had no air barrier, no vapor barrier, and substandard insulation. The HVAC equipment was located in this space. The firm proposed a master plan that included immediately reorganizing the location of the roof thermal insulation layer and establishing an air barrier layer at the roof as well. This set the stage for a future upgrade of the rest of the shell. Blower door testing showed a reduction in infiltration from 15 ACH₅₀ to 5 ACH₅₀ after the initial upgrades. The client is very satisfied with the indoor air quality, the improved comfort, and the lower utility bills. The library is looking forward to completing the EnerPHit upgrade plan that BMA is developing.

The owner of The Laundrette in Narrowsburg, New York also benefited from BMA's expertise in coupling renovations with efficiency improvements. The client wanted to convert a one-story, concrete masonry car wash and commercial laundry into a bar and restaurant containing a wood-burning pizza oven. The design strategy included exterior trenching to manage water drainage, which provided the perfect opportunity for also adding slab-edge insulation to mitigate existing thermal bridges. The exterior surfaces of the masonry walls were sealed with a liquid-applied air barrier. Continuous mineral wool was applied over the masonry walls and tied to new mineral wool on the roof. A vented fiber cement panel rain screen was then installed.

In both retrofit cases, the clients got excellent results from Passive House-inspired strategies, but they never had to wrestle with the preconception that Passive Houses are more expensive or more complicated than other building strategies. They just had to agree to embrace good design decisions that should be a part of all construction projects.

Rendering courtesy of Buck Moorhead Architect

Long Island PASSIVE HOUSE

Long Island, New York

Although some people view Passive House construction as complex and problematic, often times the non-Passive House aspects of a project can be daunting as well. That's the case with this single-family residence on Long Island. The existing, decades-old three-story structure was approximately 6,000 square feet plus a basement. The project started out as a straightforward remodel. The program was constrained because the existing footprint did not conform to current zoning requirements, and a significant remodel altering the existing footprint would have triggered a requirement for compliance with current zoning laws, limiting some design opportunities.

While in the early design phase, Project Architects Buck Moorhead, Laura Carter, and Eve Lefebvre MacDougal noticed small cracks in the existing foundation. Months later, he noticed that the cracks were larger. After some exploratory investigation, it was discovered that the foundation had no footers, was too shallow for the local frost line, and was, in fact, failing. The project team redesigned the remodel to include a new foundation, new first level

Team

Architect and Certified Passive House Consultant

[Buck Moorhead Architect](#)

Builder

Aspen & Ash

Mechanical Consultant

[Baukraft Engineering](#)

floor, and cellar excavation to attain a full 6.5-foot head height. This would typically trigger zoning compliance, but they filed using the original footprint. Approval was granted.

The new first level floor is a 4-1/2 inch concrete slab poured on top of a steel deck supported by steel beams. Both the deck and the beams rest on the foundation walls, located outside the thermal envelope. This configuration creates a thermal bridge. The team was able to reduce that thermal bridge by inserting one-half inch of a high-PSI insulating thermal break material under all bearing areas, after review and approval by the project's structural engineer.

After the thermal bridge issue was resolved, the building shell was straightforward. Seven-inch Larsen trusses were constructed outboard of the existing 2x4 walls and filled with blown-in cellulose. The walls were filled with batt insulation. The new TJI roof was insulated with blown-in cellulose as well.

The cellar ceiling was insulated between the supporting steel beams, under the steel deck, leaving the cellar unconditioned. However, the exterior thermal boundary, consisting of several inches of rigid mineral wool outside the slab and foundation wall, was continued down the outside of the new foundation and below grade to the top of the footing. Coupled with a few small electric resistance heaters, this will improve the thermal conditions in the cellar, which will be used mainly for storage.

This project is under construction. The final building will contain three separate ERVs and four and one-half tons of ducted mini-spits for heating and cooling. The tonnage is much less than the twelve tons that several of the HVAC contractors, unfamiliar with Passive Houses, recommended. Due to the maritime location, there will be a separate dehumidification system.

Products

Air/Moisture Control
[Pro Clima from 475](#)

Insulation
[Rockwool](#)

Structural Thermal Breaks
[Armatherm](#)

Rendering courtesy of Buck Moorhead Architect

Passive House Metrics

Specific space heating demand	4.4 kBtu/ft ² /yr	14.0 kWh/m ² /yr
Specific space cooling demand	3.5 kBtu/ft ² /yr	10.9 kWh/m ² /yr
Source energy use intensity (EUI)	59.9 kBtu/ft ² /yr	189.0 kWh/m ² /yr
Air changes per hour	0.9 ACH ₅₀ (design)	





Greenport Contemporary BARN

Greenport, New York

The lot where this contemporary barn interpretation was built has some dreamy qualities, including water views and a private dock. It also has less-charming features—a nearby hospital and a marina hotel to the south. By building a Passive House, architect Wayne Turett is optimizing the site's attractions and insulating himself from the noisier neighbors.

Turett originally conceived of this house as a contemporary home, but he pivoted to a fusion of his design aesthetic and a historic barn in order to secure the village's approval. In this two-story house,

Team

Architect

[Turett Collaborative](#)

Certified Passive House Consultant

ZeroEnergy Design
—jg@ZeroEnergy.com

General Contractor

Vector East
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HVAC Contractor

Kolb Mechanical
—jzurawski@kolbmechanical.com

Electrical Contractor

BJ Electric—rpa4300@yahoo.com

the combined kitchen, dining, and living rooms are placed upstairs to access broader views. Cathedralized ceilings in this great room contribute an airy feel, reminiscent of a more urban loftlike experience. Just off the great room, a porch, shaded by overhangs, facilitates soaking up those water views. Downstairs, an outdoor shower helps smooth the transition from sandy shore to the three bedrooms and two bathrooms inside.

Fortunately, although the bay is nearby, the house sits 12 feet above the water and is not in a floodplain. Its full basement is insulated below the slab with 7 inches of XPS and two inches of polyiso around the perimeter walls, with another 6 inches of polyiso on the interior.

The home's wall assemblies consist of 2 x 6 framing that is insulated with fiberglass, a proprietary sheathing taped to form the air barrier, 4 inches of polyiso, and cedar siding fastened to ¾-inch furring strips, forming a rain screen gap. The roof is constructed similarly, but with 6 inches of polyiso exterior to the proprietary sheathing and rafters filled with 10 inches of fiberglass. Metal roofing tops this assembly and once it was closed up, Turett noticed immediately how long snow sits frozen on the well-insulated roof. This all-electric house is being heated and cooled with a ducted mini-split system, aided by an ERV.

Turett couldn't find a builder experienced with Passive House construction in eastern Long Island, so he ended up acting as the general contractor for this house, sometimes making material choices based on local subcontractor preferences. He did eventually team up with Jared Loveless of Vector East, who embraced his Passive House goals.

Turett's architectural practice has long focused on developing design solutions that address the real needs of his clients and bring lasting value to their projects. Now that he has experienced the benefits of Passive House for himself, Turett is eager to bring its advantages to future clients.



Products

Windows & Doors

[Bildau & Bussmann](#)
by [Eco Supply](#)

Air/Moisture Control

[ZIP System Sheathing](#)
and [Tape](#)

Skylights

[Fakro from 475](#)

Photos courtesy of The Turett Collaborative

Passive House Metrics

Specific space heating demand	4.6 kBtu/ft ² /yr	14.5 kWh/m ² /yr
Specific space cooling demand	2.7 kBtu/ft ² /yr	8.5 kWh/m ² /yr
Source energy use intensity (EUI)	27.2 kBtu/ft ² /yr	85.8 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	

ARTIST'S Studio

Orient, New York

This artist's studio on the North Fork of Long Island was one of the first projects in North America to receive international

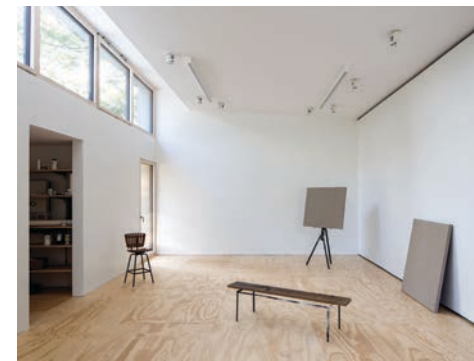
Passive House certification. As a result, the heating and air-conditioning needs are dramatically reduced. The studio is clad in recycled timber, applied as a rain screen to protect the thick insulated walls and reduce air infiltration. Windows are also of special construction, with triple-pane glass and highly insulated frames providing a comfortable, stable, interior environment. PV panels more than offset the building's electrical use, resulting in a net zero building.



Team

Architect

[Ryall Sheridan Architects](#)



Photos by Ty Cole

Products

Air/Moisture Control

[Pro Clima from 475](#)

[Sto](#)

Ventilation

[Zehnder America](#)

Passive House Metrics

Specific space heating demand	4.4 kBtu/ft ² /yr	14.0 kWh/m ² /yr
Source energy use intensity (EUI)	34.6 kBtu/ft ² /yr	109.0 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀	

Westport CONTEMPORARY

Westport, Connecticut

The homeowners approached architect John Rountree with sketches and expectations. They already owned a net zero energy vacation home in Vermont that never dropped below 60°F indoors even with the heat off. Now they wanted a principal residence that replicated that level of performance and comfort. Thanks to clever detailing and a superinsulated envelope, this almost 7,000-ft², H-shaped house delivers on the owners' expectations. With a 10.7-kW PV system, the family's average monthly utility bill is just \$20—the utility hookup fee.

The main wing houses a kitchen and a great room on the ground floor with a master bedroom and two children's bedrooms above. A grand entrance foyer connects this wing with a smaller one that contains additional bedrooms and an office. The home's comfort stems from a 13-inch double-wall assembly that achieves an R-55 using 8½ inches of dense-packed cellulose and 2 inches of closed-cell spray foam. The R-84 attic features 24 inches of cellulose, and below the slab 8 inches of EPS deliver an R-value of 36.

The triple-pane windows were located carefully to maximize natural light and to reap free solar heat. To reduce summertime heat gain and prevent overheating, the windows are set back several inches into the wall assembly. A wonderful side benefit of these windows, the owners say, is their ability to

Team

Architect
Rountree Architects

**Builder and Certified
Passive House Consultant**
BPC Green Builders



almost eliminate the traffic noises emanating from a busy nearby road.

A ducted air source heat pump system provides heating and cooling, aided by an ERV that supplies a steady stream of fresh air. Water is heated by a heat pump. The homeowners wanted a fireplace for its cozy aesthetic, so BPC Green Builders installed a sealed-combustion, direct-vent, natural-gas fireplace. During a week of extreme cold, the owners turned the heat pump off, assuming it would be working inefficiently, relying instead on this fireplace, which kept the whole house in the 65°F to 70°F range.

"It's unfortunate that there aren't more homes like this that are available to buy," says Rountree. With the growing consciousness of climate change and the need for energy security, he sees the demand for this type of home increasing, but the supply isn't keeping pace. He is working to educate builders, developers, and investors on the advantages and cost-effectiveness of building to achieve Passive House targets.

Products

Windows & Doors
[Unilux](#)

Air/Moisture Control
[ZIP System Sheathing and Tape](#)

Photos courtesy of BPC Green Builders

Passive House Metrics

Specific space heating demand	4 kBtu/ft ² /yr	12.6 kWh/m ² /yr
Specific space cooling demand	5 kBtu/ft ² /yr	15.8 kWh/m ² /yr
Source energy use intensity (EUI)	20 kBtu/ft ² /yr	63.1 kWh/m ² /yr
Air changes per hour	0.39 ACH ₅₀	





FLIP FLOP House

Long Branch, New Jersey

In the wake of Superstorm Sandy, a phased Passive House heightened-resiliency retrofit was begun on a 950-ft² single-family cottage on the Jersey Shore. Inspired by a “flip-flop” sandal’s ability to shed water and not get damaged, lead architect Shawn Torbert worked with the Civilian Conservation Corporation to choose moisture-resistant, fast-drying building materials to minimize damage in the event of another coastal flood.

This affordable housing project was subsidized through the Re:New Jersey Stronger grant program and aims to be a proof-of-concept Passive House retrofit for low- to middle-income coastal communities.

A new thermal-bridge-free building envelope was constructed with 6 inches of an exterior stone wool insulation board and a panelized vented rain screen façade. By combining a highly vapor-permeable water-resistive barrier with vapor-permeable stone wool insulation and a drained and ventilated rain screen façade, the home can dry quickly toward the outside.

The interior existing stud wall was filled with 4 inches of stone wool batt

Team

Architect
[Shore Point Architecture](#)

Certified Passive House Consultant
[Civilian Conservation Corporation](#)

Builder
Mangan Development Group

Carpenter
David Fowler

Landscape Design
[Habitat Landscape Management](#)

insulation. The interior service cavity was clad with painted wood bead board—instead of gypsum board—as the bead board can easily be deconstructed, cleaned, dried, and reinstalled.

The floor is a “sacrificial” floating floor on top of taped OSB and 1.25 inches of the rigid stone wool insulation. The floor joists are filled with 12 inches of stone wool batts above the vented crawl space. The pitched attic rafters are filled with 4 inches of stone wool batts held in place with 3 inches of rigid stone wool attached to the underside.

With just one 5-foot-long electric baseboard heater and an ERV, the home has been delivering Passive House levels of comfort in winter. Wintertime utility bills in this all-electric home rarely exceed \$50 per month. The home has overheated at times in summer, so indigenous fruit trees have been planted to shade the south-facing elevation and further improve summertime comfort.



Products

Air/Moisture Control
[Pro Clima from 475](#)

Insulation
[Rockwool](#)

Photos by Phil Von Schondorf

Passive House Metrics

Specific space heating demand	4.4 kBtu/ft ² /yr	1.3 kWh/m ² /yr
Specific space cooling demand	5.1 kBtu/ft ² /yr	1.5 kWh/m ² /yr
Source energy use intensity (EUI)	34.1 kBtu/ft ² /yr	10 kWh/m ² /yr
Air changes per hour	<1.0 ACH ₅₀	

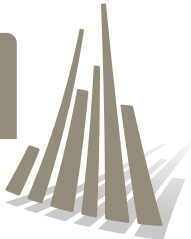


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Team

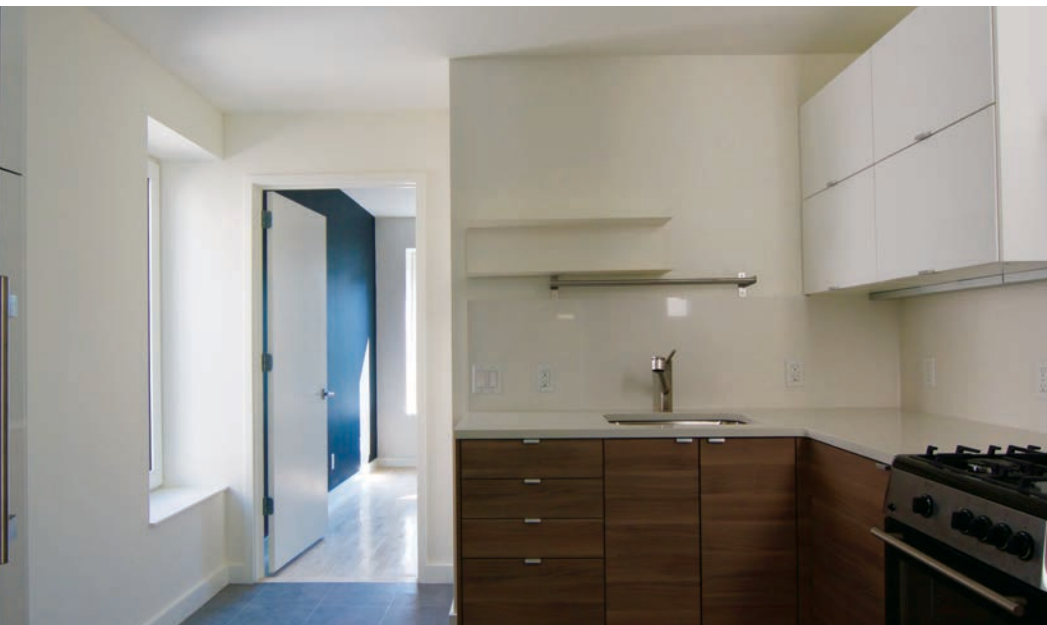
**Architect and Certified Passive
House Consultant**

DAS Studio

When a client first approached Design And Solutions (DAS) Studio with the idea of a Passive House renovation on her co-op apartment, her motivations were obvious—but the challenges were even clearer. Her 580-ft² apartment was being heated with three direct-vent gas heaters, which needed replacing for a host of reasons. It also overlooked a nightclub, and the nightly noise was seriously disturbing her sleep.

But tackling a single apartment inside of an inefficient co-op building is a difficult proposition. Due to the co-op rules, no changes could be made to the exterior of the envelope, including the rough openings. Added to that, the apartment was on the highest floor, and it had low ceilings and a small rectangular extension in the back connected by a narrow, uninsulated corridor.

DAS Studio's options were limited, so it did what it could as thoroughly as possible. After demolition, the existing masonry wall was repaired and sealed where required, and a vapor-open air barrier membrane was taped to the inside of the newly built 2 x 4 furring walls and the roof joists. All penetrations and even the smallest holes were taped and sealed, and the rebuilt walls and roof were insulated with dense-packed cellulose. DAS Studio then had an insulated service cavity installed on the interior using 2 x 3 battens, so that wires, outlets, and air-conditioning lines could be run through without disrupting the air barrier.



The old leaky windows were replaced with triple-pane, aluminum windows, cutting the nighttime noise significantly. To bring daylight to the bathroom, DAS Studio installed an airtight thermally broken and insulated solar tube.

Once the aging gas heaters were removed, DAS Studio reused the three rough openings for through-the-wall ventilation units with heat recovery, bringing in tempered fresh air year-round. For heating and cooling, it opted for two of the smallest ductless mini-split units available. While one unit would have been enough to cover the heating-and-cooling demand, the unusual shape of the apartment made it necessary to install two.

Post-renovation the overall look of the apartment is simple and understated. The light coming in through the windows is bright, yet does not overheat the apartment. The apartment stays surprisingly cool during even the hottest summer weeks, and the owner reports rarely using the cooling. The need for heat is similarly low, with the thermostat showing 68°F inside, even with no heat on, on a bright January day when it was 19°F outside. Although the apartment does not meet EnerPHit requirements, the renovation is a model of what can be accomplished by applying Passive House methodology to a very challenging situation.



Photos by Stefanie Werner

Passive House Metrics

Specific space heating demand	12.1 kBtu/ft ² /yr	38.1 kWh/m ² /yr
Specific space cooling demand	2.9 kBtu/ft ² /yr	9.2 kWh/m ² /yr
Source energy use intensity (EUI) (renewable)	33.4 kBtu/ft ² /yr	105.4 kWh/m ² /yr

Products

Windows

Klearwall

Ventilation

Lunos by 475

Paul A. CASTRUCCI Architect

Paul A. Castrucci, R.A. is a Registered Architect with the states of New York and New Jersey. He has more than 30 years of experience in architectural design, planning, and construction. He has long been an advocate for energy-efficient design, and is now leading the design and construction of an innovative commercial Passive House in New York City—the community arts facility for the group ABC No Rio. He also designed R-951, New York City's first building to have both Passive House and Net Zero Ready certifications, and is currently designing a number of larger-scale affordable housing projects to the Passive House standard. His ten-person firm, located in a first-floor studio in Manhattan's Lower East Side, includes two Certified Passive House Designers.

The firm leverages its sustainability and design expertise with a practiced knowledge of code, zoning, and administrative procedures, making it a strong advocate for its clients. The firm has extensive experience in extremely energy-efficient design, affordable housing, loft conversions, building legalization, air rights, zoning analysis, and Landmarks approvals. It is also experienced in leveraging Enterprise Green Community requirements and obtaining New York State Energy Research and Development Authority financial incentives to help offset the cost of energy-efficient technologies. It can identify potential pitfalls early in the design process, seamlessly integrating code and zoning requirements to maximize client benefits.

Over the past decades, Paul Castrucci has been actively involved in the community and its development. He has guided architectural conversion of hundreds of housing units in the neighborhood—including numerous affordable housing units—and has built living and working spaces for artists. He has worked on projects located throughout New York State, from interior finishes to historic



preservation for low-income community groups and government agencies, as well as private residences.

He has extensive experience in all areas of housing and residential construction, as well as corporate offices and cultural facilities. His architectural work stresses the importance of building design responsive to the culture in which it will be situated, and to sustainable construction materials and energy-efficient design. Throughout his career, Castrucci has promoted the inclusion of energy responsible design. He believes that where practicable, buildings should satisfy all or a portion of their energy needs through passive or active solar heating, PV electric generation, natural daylighting, and ventilation.

The project at Morrisania crossing, designed in response to an RFP, exemplifies the firm's melding of responsive design and efficiency. Morrisania is a 200-unit mixed-use project with studios and one- and two-bedroom apartments. Situated in a vibrant, diverse community that includes other

Rendering courtesy of Paul A. Castrucci Architect

public housing buildings, the project includes a roof garden, a community kitchen, and an education center. Planned uses for the community center include an exercise space and a neighborhood healthy-cooking center. As a supportive housing center, it will have social workers on site.

The building is situated across the street from a large community park. The design includes a series of green spaces on the façades and staggered roof terraces to mirror the park's greenery. The building massing and terracing were designed to maximize southern exposure and minimize shading on the park and the street.

The firm looked at all aspects of the building to determine if it could be built as a Passive House and Energy Green Communities project with no increase in cost. This exercise was necessary to garner not-for-profit developer support. The process included extensive discussions with the general contractor to verify costs.

Among the costs that the team compared were that of double- and triple-pane windows and that of code level insulation versus the amount of insulation required to meet Passive House requirements. The building differs from some



high-density housing projects in that its cooling load is less than its heating load—it required a significant amount of glazing to satisfy the heating load. With utility savings, the team was able to cost justify better windows and more insulation on the walls and roof.

Final recommendations include a cogeneration system on the roof for domestic hot water, three ERVs for ventilation, and a commercial-grade heat pump that heats and cools all the units and the commercial spaces. The ERVs will be distributed throughout the building to minimize ductwork.

The design team was able to show that the additional cost to build to Passive House standards is less than 1%—so small as to be negligible. The centralized ERVs, even operating at 70% efficiency, delivered the largest savings. With strong community support, and a design that truly complements the neighborhood, Morrisania Crossing sets an ambitious standard for affordable housing.

Paul A. Castrucci's Passive House work has been featured in *Oculus*, *Dwell*, the *Architect's Newspaper*, *Inhabitat*, *Green Building Advisor*, the *New York Times*, and many other publications. His Passive House projects have won local, regional, and national awards. He has presented on many Green Home NYC tours and NY Passive House tours, as well as at Parsons Institute, the NYC Department of Design and Construction, NYC Climate Week, and many other venues.



Renderings courtesy of Paul A. Castrucci Architect



ABC No Rio

New York, New York

ABC No Rio is a progressive and socially responsible community arts organization with roots in the Lower East Side dating back to the 1980s. Almost ten years ago, it realized that it needed more space. The resulting five-story building has two lower floors devoted to performance venues and gallery space for up to 180 people. The upper three floors are smaller offices and meeting rooms. When it is completed in 2019, ABC No Rio's new headquarters is expected to be one of the first commercial Passive House

Team

Architect

[Paul A. Castrucci Architect](#)

Certified Passive House Consultant

[ZeroEnergy Design](#)



buildings in New York. According to architect Paul Castrucci, it was easy to convince the energy-conscious client to pursue Passive House certification. In addition, the project is a collaboration with several New York agencies, including New

York's Department of Cultural Affairs, New York City Economic Development Corporation, and New York's Department of Design and Construction. All participants are enthusiastic supporters of Passive House construction.

The building, expected to achieve LEED Silver certification, is an oasis of green in an otherwise-dense urban setting. The original building, which had insufficient exhibition space, had a large green space in the rear. To compensate for the lost greenery, the second and fifth floors have partial green roofs. In addition, the south-facing front is covered with deciduous planting to reduce summertime heat intrusion and cooling loads.

As expected for a Passive House project, the design team paid close attention to air sealing. The concrete masonry shell was coated with an air sealer on the inside. In addition, a secondary air-sealing layer was added on top of the exterior insulation, a combination of polyisocyanurate and mineral wool.

Thermal bridging calculations were done for all significant junctions, especially the corners. This extra attention was necessary because the building includes quite a bit of structural steel. Window headers are steel tubing. There are also large steel I-beams at the roof underneath the parapet wall.

Because the building is divided into medium-capacity public spaces and private spaces, two different ventilation schemes were incorporated into the design. A large roof-mounted ERV services the lower two floors, while multiple smaller ERVs service the upper floors. This split approach provides better control. The same approach was used for the heat pumps that provide cooling and backup heating.

Products

Windows & Doors

[Yaro](#)

Air/Moisture Control

[Pro Clima from 475](#)

[Sto](#)

Façade System

[Knight Wall Systems](#)

Ventilation

[Zehnder America](#)

Renderings courtesy of Paul A. Castrucci Architect

Passive House Metrics

Specific space heating demand	2.2 kBtu/ft ² /yr	6.4 kWh/m ² /yr
Specific space cooling demand	0.8 kBtu/ft ² /yr	2.6 kWh/m ² /yr
Source energy use intensity (EUI)	35.4 kBtu/ft ² /yr	111.7 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	

158 CLIFTON Place

Brooklyn, New York

Team

Architect

Paul A. Castrucci Architect

Builder

BlueLine Construction

Certified Passive House Consultant

Right Environments

The owner of this two-family row house in Brooklyn also owns a reclaimed-wood business and brought a lifelong passion for optimal reuse to this Passive House retrofit. Its front façade features recycled Douglas fir, charred shou sugi ban style. This process protects the wood from the elements, making the façade virtually maintenance-free for decades. Charring the recycled fir, which otherwise would be unsuitable for the exterior, makes the best use of this material. The rear façade is covered in ipe hardwood

reclaimed from a Coney Island boardwalk that was damaged during Superstorm Sandy.

The upper three floors comprise the owner's unit, while the lowest floor is a rental apartment. The building is a wood-framed structure, a rarity in New York City. Some of the typical Passive House details used in other projects needed to be modified to account for the different thermal and moisture conditions of the structure.

To optimize the air-sealing process, the firm started with limited demolition and probing to identify the existing assemblies. It then developed air-sealing details specifically for the project and created mock-ups for the builder. During construction, the team followed up with contractor training and inspections to ensure proper installation.

The façades were fairly straightforward, requiring just an air barrier membrane inside the existing stud walls and the addition of a utility channel. The sidewalls, composed of both brick and framing, were more complex. First, an air barrier membrane was installed on the existing 4-inch framed walls. Then the builder taped around each existing joist, and finished with a structural ledger. According to architect Grayson Jordan, this meticulous detailing was the most difficult air-sealing job of his career.

Insulating the structure, on the other hand, didn't present any particular challenges. Three inches of rigid insulation were added to the outside, and cellulose insulation was blown into the existing stud cavities. Technically, the sidewalls didn't need to be insulated, but they were insulated anyway for noise reduction. The roof and basement floor were insulated with reclaimed polyisocyanurate—6 inches for the roof and 2 inches for the basement.

The building's mechanical systems are designed to minimize energy use. High-efficiency mini-split units heat and cool the apartments. Heat pump water heaters supply hot water, and energy-efficient appliances and LED lighting are used throughout. A 7.5-kW PV array is installed on the roof, delivering near net zero performance.

Products

Air/Moisture Control
Pro Clima from 475

Sto

Insulation
Rockwool

Sto



Photo courtesy of Paul A. Castrucci Architect

Passive House Metrics

Specific space heating demand	6.3 kBtu/ft ² /yr	20 kWh/m ² /yr
Specific space cooling demand	3.5 kBtu/ft ² /yr	11 kWh/m ² /yr
Source energy use intensity (EUI)	36.1 kBtu/ft ² /yr	114 kWh/m ² /yr
Air changes per hour	1.0 ACH ₅₀ (design)	

R-951 Passive House

New York, New York

The R-951 Residence, a row house with three 1,500-ft² duplex condos that was designed by Paul Castrucci Architect, was the first building in New York City to achieve both Passive House and the Net Zero Energy Capable certification set by the New York State Energy Research and Development Authority. Beautifully constructed, the building is clean, quiet, and comfortable in all seasons.

Designed for resiliency, the thermal-bridge-free, high-performance building envelope was constructed using an ICF superstructure. Each all-electric apartment has its own ERV to bring in constant fresh air, a heat pump water heater for hot water, a mini-split heat pump for heating and cooling—and private outdoor space. The building has a 1,200-gallon rainwater collection system, contributing to its overall sustainability.

A grid-tied 12.5-kW PV system tops the roof, yielding approximately 4 kW per apartment. Each apartment has its own inverter that can be switched to supply daytime backup power during a utility outage. This Passive House building has been estimated to reduce carbon emissions by 320,000 metric tons annually, compared to a conventionally built row house, directly addressing Mayor de Blasio's "80 by 2050" goals.

Team

Architect

[Paul A. Castrucci Architect](#)

Certified Passive House Consultant

[ZeroEnergy Design](#)

Builder

[Integral Building](#)

Developer

[Further, Incorporated](#)

Solar

[Aeon Solar](#)

Products

Windows & Doors

[Yaro](#)

Air/Moisture Control

[Sto](#)

Façade System

[Knight Wall Systems](#)

Ventilation

[Zehnder America](#)



Photos courtesy of Paul A. Castrucci Architect

Passive House Metrics

Specific space heating demand	4.7 kBtu/ft ² /yr	14.8 kWh/m ² /yr
Specific space cooling demand	4.0 kBtu/ft ² /yr	12.5 kWh/m ² /yr
Source energy use intensity (EUI)	34.6 kBtu/ft ² /yr	109 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀	

ZEROEnergy Design

There is an inextricable link between design and performance, says Jordan Goldman, engineering principal of ZeroEnergy Design, a firm specializing in high-performance homes and buildings. Yet that doesn't mean a building's architectural style must be dictated by the project's performance goals. Quite the contrary. From traditional brownstone to ultramodern multifamily, ZeroEnergy Design helps architects achieve a consistently high level of performance for their buildings, regardless of the style.



At the firm's core are Jordan Goldman, who manages the firm's energy consulting and mechanical-design practice; Adam Prince, chiefly responsible for business development; and Stephanie Horowitz, who manages the architecture practice. ZeroEnergy Design was founded 12 years ago with a focus on creating high-performance buildings. About 50% of its consulting work is single-family residential, with the balance being multifamily. In the New York area the firm mainly provides Passive House consulting for architects targeting high levels of performance.

Roughly half of its consulting work is renovations, generally Passive House or deep-energy retrofits. Single and duplex row homes are common, as are larger four- to six-story multiunit buildings. Among the firm's recent projects are a gut renovation of a duplex in the Park Slope neighborhood of Brooklyn and a new building in Tribeca with more than 20 units.

While ZeroEnergy Design's clients have always sought it out for its high-performance expertise, more recently most are also asking for increased resiliency in the face of extreme weather events and power outages. Passive House strategies and modeling with the Passive House Planning Package, which Goldman does for nearly every project, help ZeroEnergy Design achieve these goals, even though most clients skip the option of certification. The improved building envelope stabilizes interior temperatures, slowing any temperature shifts when a power outage does occur. Whenever possible, mechanical systems are designed to occupy high and dry spaces, avoiding damage in the case of floodwaters.

Goldman is sensitive to the issue of categorizing buildings as meeting Passive House standards when they don't, so he unequivocally says that not all of ZeroEnergy's projects end up as Passive House buildings—but the vast majority come very close to meeting the performance targets. All of its projects are designed to be superinsulated and superairtight, and to cut heating energy use by 75%–90%.

When a project's energy performance metrics fall just shy of Passive House targets, it's typically because getting there would involve decisions or changes to specs that the firm doesn't see as being in the best interests of the client. And that's not how ZeroEnergy Design works. "On each project, we make decisions that are in the best interest of the client and the project," says Goldman.

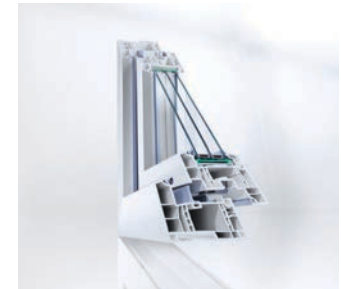
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Baxt INGUI Architects

Baxt Ingui Architects, a 24-person architectural and interior design firm based in Manhattan, has been serving up high-quality design, with townhouses as a specialty, for 40 years. About a decade ago, a neighboring Passive House project being done by Sam McAfee caught the attention of one of the firm's partners, Michael Ingui Architects. How could this renovated townhouse possibly function well using just one mini-split for heating and cooling? In a characteristic move, Baxt Ingui set out to improve the services it was delivering to its clients by learning all about the Passive House approach.

Today Baxt Ingui is working on its twelfth Passive House townhouse. Seven of them are finished and occupied, and five are in various stages of completion. Almost all of the design staff have taken the Certified Passive House Designer's training, thanks to Baxt Ingui's decision several years ago to host an in-house course for all of its employees, two nights a week for nine weeks. Baxt Ingui invited the mechanical engineer and installer it relies on most commonly to participate as well, which they did. "It was intense," admits Ingui, "but also fun."

The firm has always put a premium on continuing education, a proactive approach that extends beyond its own employees to the contracting firms it works with. Ten years ago Baxt Ingui had hired a semiretired, highly skilled residential contractor, Bob Helenius, to visit its jobsites and critique the ongoing work, including the firm's details. At first the jobsite contractors were uneasy with this sort of supervision, but they quickly became enthusiastically reliant on Helenius's mentoring and professional advice.

Building on this model, in recent years Baxt Ingui has fostered an extremely rare collaborative Passive House mentoring among the various contractors, engineers, and consultants who work on its townhouse projects. It's revolutionary, says Ingui, who encourages the contractors to meet every few months to commend the details they like, commiserate on those they don't, and generally pick apart the drawings. "I have had some contractors want to come who aren't even working for us," says Ingui. A favorite meeting time is just after a project's initial blower door test, an ideal occasion to discuss what worked really well, any issues that may have arisen, and how to detail those trouble spots better the next time.

This collaborative approach is evident from the beginning of any project Baxt Ingui designs. Early on in the process—before the final design is sketched out—the firm schedules a meeting with the Passive House consultant and the clients to



ensure that their expectations are well grounded. "We don't want the client to get excited about a design feature, such as a large window on the north-facing façade, that will likely end up changing to meet Passive House targets," says Ingui. Ingui sets up another early meeting, this one before the construction drawing set is finalized, with the contracting team to make sure it will be comfortable with the details as drawn. "That meeting cuts down on any change orders," he explains. A third essential preconstruction meeting is with the contractor and all the subcontractors to review the project scope and get everyone excited about the Passive House goals.

Abetted by these collaborative processes, the firm has been successfully delivering Passive House performance long enough to collect occupant feedback—which it has done. To better understand how its houses are working, it has been interviewing clients a year after they move in. Here are just two of the comments it has collected: "These houses are incredibly quiet. To be in the middle of NYC and feel serenity is amazing." "Even when you described how great the fresh air would be, I couldn't have predicted how truly wonderful it is."

Photo courtesy of Adam Kane Macchia Photography



First CERTIFIED Passive House in a LANDMARK DISTRICT

Brooklyn, New York

This project was Baxt Ingui's second Passive House, one of the earliest Passive Houses submitted to the Landmarks Preservation

Team

Architect

Baxt Ingui Architects, P.C.

Certified Passive House Consultant

Sam McAfee—sam@fentrend.com

Landscaping

Gunn Landscape Architecture,
PLLC

Interior Design

Shawn Henderson

Commission, and eventually the first Certified Passive House in a historic district. During this renovation the firm developed a repeatable template for the Passive House process that involved open communication among the in-house team, the general contractor, engineers, consultants, and Passive House certifiers. This communication, along with weekly on-site meetings, helped to create details that were more efficient and more effective every step of the way. Baxt Ingui continues to hone this successful practice.

To address Landmarks' concerns, the firm worked collaboratively with a number of preservationists as well as other general contractors who were concurrently working on the firm's projects. The renovation included digging out the cellar to accommodate a small-scale basketball court—a rear addition that had to work with the neighbor's angled wall to meet Landmarks' requirements—and a rooftop addition that walks out onto a large roof deck. While most of the exterior detail at the front façade was still intact at the start of the project, the interior historic detail had been previously removed. With this blank slate, Baxt Ingui was able to design an open and contemporary layout that expanded and maximized the square footage.

Products

Windows & Doors

Zola

Air/Moisture Control

Pro Clima from 475

Insulation

Rockwool



Photos by Peter Pierce

Passive House Metrics

Specific space heating demand	6.9 kBtu/ft ² /yr	22 kWh/m ² /yr
Specific space cooling demand	3.8 kBtu/ft ² /yr	12 kWh/m ² /yr
Source energy use intensity (EUI)	37.4 kBtu/ft ² /yr	118 kWh/m ² /yr
Air changes per hour	0.7 ACH ₅₀	

Brooklyn Heights Passive TOWNHOUSE

Brooklyn, New York

By applying Passive House principles to this Landmark District townhouse renovation, Baxt Ingui was able to greatly reduce the size and complexity of the mechanical system—and the space ordinarily devoted to it throughout the house. The resulting design freed up the interior spaces, including a double-height dining space that connected the kitchen to the living room on the floor above without any interruptions or soffits. The use of a single condensing unit for the entire six-story home plus roof bulkhead allowed for a fantastic outdoor patio on the roof, rather than the large, high-tonnage units that would otherwise have been required.

Team

Architect
[Baxt Ingui Architects, P.C.](#)

**Certified Passive House
Consultant**
[Baukraft Engineering](#)

Landscaping
[Sabin Landscape Architects](#)

The Landmarks Preservation Commission was adamant about retaining the character of the historic bay window at the rear wall, which is visible from the street. To do this, the insulation around the columns had to be minimized. This reduction in insulation was offset with an ultratight air seal and a continuous wrapping of rigid insulation around the steel frame to prevent thermal bridging. These careful details made the restoration of the bay possible, while providing for a beautiful view and access to the rear yard.

This project was an enthusiastic collaboration not just on the Passive House objective, but also on the interior design and finishes, with Pat Starr Interior Design. Traditional touches like full-height wall paneling on the parlor floor and carefully selected textured furnishings balance out the contemporary, custom-designed Bocci pendant chandelier that is suspended two stories over the dining table.



Photos by Peter Pierce

Products

Windows & Doors
[Zola](#)

Insulation
[Rockwool](#)

Ventilation
[Zehnder America](#)

Passive House Metrics

Specific space heating demand	6 kBtu/ft ² /yr	18.9 kWh/m ² /yr
Specific space cooling demand	3.7 kBtu/ft ² /yr	11.5 kWh/m ² /yr
Source energy use intensity (EUI)	32.5 kBtu/ft ² /yr	103 kWh/m ² /yr
Air changes per hour	0.5 ACH ₅₀	

Brooklyn Heights HISTORIC DISTRICT Passive TOWNHOUSE

Brooklyn, New York

As a developer home in a New York City Landmark District, this townhouse project brought some unique challenges to Baxt Ingui.

The client chose to pursue Passive House for this single-family brownstone, knowing that this approach provides a better-built product with tangible benefits. Baxt Ingui Architects worked closely with the New York City Landmarks Preservation Commission to retain the exterior's historical context while creating a more modern interior. The completed project includes a six-story open stair, six bedrooms with en-suite bathrooms, a wine room, movie room, and dance studio, and a roof deck with an outdoor wet bar.

On the rear façade, enlarged masonry openings and exterior pocket doors help to bring in light and a sense of indoor-to-outdoor living to the garden and parlor floors. Restoration of the front façade was a collaboration between Baxt Ingui and local craftsmen to research and reinstall the original brownstone stoop, entryway framing, and window heads and sills. The interior finishes—a collaboration between Baxt Ingui and Gerard Beekman—were inspired by the original details, yet delivered a clean and updated look.

Team

Architect
[Baxt Ingui Architects, P.C.](#)

Interior Design
Gerard Beekman Architect

Certified Passive House Consultant
[Baukraft Engineering](#)

Landscaping
[Nievera Williams Landscape Architecture](#)



Products

Windows & Doors
[Zola](#)

Air/Moisture Control
[Pro Clima from 475](#)

Ventilation
[Zehnder America](#)

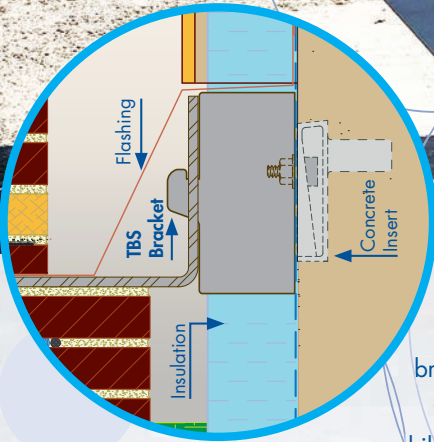
Photos by Mike Tauber

Passive House Metrics

Specific space heating demand	5 kBtu/ft ² /yr	15.8 kWh/m ² /yr
Specific space cooling demand	4.5 kBtu/ft ² /yr	14.2 kWh/m ² /yr
Source energy use intensity (EUI)	29 kBtu/ft ² /yr	91.4 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀	

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Bergen Street ROW HOUSE Retrofit

Brooklyn, New York

This Brooklyn row house, built originally in the 1870s, was visibly distressed before its Passive House retrofit, or EnerPHit, makeover. The home's classic brick façade was preserved, along with its mahogany stair railings and marble mantel, while the interior was completely rebuilt. All of the regularly spaced and sized window openings in this three-story building were also left unchanged, but were fitted with new high-performance, triple-pane units.

Making way for subslab insulation required digging out the existing slab, so architect Jane Sanders opted for excavating an additional foot to create more usable space. In the old slab's place, a gravel layer with perforated pipes was laid down first,

Team

**Architect and Certified
Passive House Consultant**
[Jane Sanders Architect](#)

Builder
Build with Prospect

Mechanical Engineer
[Baukraft Engineering PLLC](#)

topped by a waterproof membrane, 4 inches of below-grade EPS insulation, and a new slab. The front portion of the cellar is still below grade, so that is used for storage, but the rear portion has been transformed into a half bath and a family room that opens onto the backyard.

The existing exterior walls were stripped down to the interior face of the brick as a prelude to air sealing, and all of the deteriorating joists were replaced. A smart vapor retarder on the inside of the exterior walls and a fluid-applied air barrier on the party walls secured the desired airtightness.

A variety of insulation products were used in this retrofit. Dense-packed cellulose was used wherever possible, but certain areas, such as the cellar, required different products. There, mineral wool was used for its moisture resistance and sound absorption.

An ERV helps to keep the house comfortable year-round, aided by a separately ducted mini-split heat pump. The mini-split's two air-handling units each service two floors. There was just enough space on the roof for an evacuated-tube solar-thermal system, which supplies most of the family's annual hot water needs.

In winter, storms may bluster but very little heat suffices to keep this home incredibly comfortable. Its summertime comfort is abetted by seasonal shading from a large tree across the street and a ginkgo tree just in front of the house's south-facing façade. Year-round, the home provides a peaceful retreat from New York's busy streets.



Products

Windows & Doors
Makrowin by [European Architectural Supply](#)

Air/Moisture Control
[Pro Clima from 475](#)

Skylights
[Lamilux from 475](#)

Photos by Jane Sanders (opposite page) and Adam Bell (above)

Passive House Metrics

Specific space heating demand	7.9 kBtu/ft ² /yr	25 kWh/m ² /yr
Specific space cooling demand	3.5 kBtu/ft ² /yr	11 kWh/m ² /yr
Source energy use intensity (EUI)	30.4 kBtu/ft ² /yr	96 kWh/m ² /yr
Air changes per hour	0.8 ACH ₅₀	

State Street RETROFIT

Brooklyn, New York

This four-story brick townhouse was gut renovated and expanded with a three-story addition in the back, built using ICFs. The garden level has a separate studio apartment in front and an indoor, 8-foot by 13-foot swim-in-place pool in back. Although the pool area is within the home's thermal envelope, addressing the humidity issues posed by this special use required air sealing the room off from the rest of the house and installing a separate, small-capacity HRV there.

Team

Architects

Prospect Architecture
[Jane Sanders Architect](#)

Builder

[The Remy Group](#)

Mechanical Engineer

[ZeroEnergy Design](#)



EXTERIOR Townhouse Retrofit

Brooklyn, New York

This townhouse's original street-facing brick wall had been overlaid with faux-stucco in the mid-20th century. With no historic façade to save, this retrofit could proceed from the exterior. Removing the stucco

Products (for both)

Air/Moisture Control
[Sto](#)

Insulation
[InSoFast](#)

Skylights
[Lamilux from 475](#)

Windows
(State Street) [Zola](#)
(Exterior Retrofit) [Ikon](#)

would have inflicted too much damage to the brick, so architect Jane Sanders chose to apply an exterior insulation and finish system (EIFS) over the brick façade.

The missing cornice was reconstructed using EIFS as well. The back façade was rebuilt using concrete block, EIFS on the outside, and preassembled insulated panels on the interior.

Team

Architect and Certified Passive House Consultant
[Jane Sanders Architect](#)

Builder

[Mobili De Angelis](#)

Mechanical Engineer

[Baukraft Engineering PLLC](#)

Photos by Jane Sanders

Passive House Metrics

Specific space heating demand	3.2 kBtu/ft ² /yr	10 kWh/m ² /yr
Specific space cooling demand	7.6 kBtu/ft ² /yr	24 kWh/m ² /yr
Source energy use intensity (EUI)	37.4 kBtu/ft ² /yr	11.8 kWh/m ² /yr
Air changes per hour	1.0 ACH ₅₀ (design)	

Passive House Metrics

Specific space heating demand	2.4 kBtu/ft ² /yr	7.5 kWh/m ² /yr
Specific space cooling demand	5.4 kBtu/ft ² /yr	17.1 kWh/m ² /yr
Source energy use intensity (EUI)	26 kBtu/ft ² /yr	82 kWh/m ² /yr
Air changes per hour	0.9 ACH ₅₀	

Extending the Passive House EXPERIENCE

Brooklyn, New York

Ruth Mandl, coprincipal with Bobby Johnston of CO Adaptive Architecture, can testify firsthand to the joys of a Passive House building. Her parents live in a Passive House in Austria. Searching for a place to recreate that experience, Mandl and Johnston bought a Brooklyn brownstone that was originally built in 1889. Their renovation looks to meld the original character of this row house with modern systems to achieve superior energy efficiency and preserve its usefulness for another century.

Mandl and Johnston are also extending this Passive House building's utility in a more novel fashion—by turning the garden level into a separate apartment that is available for short-term rentals. They are excited to be able to offer guests a place to experience true Passive House comfort levels and are hopeful that a host of visitors—from wavering clients to dubious designers—will find even short stays educational.

Photos by Peter Dressel

Team

Architect and Passive House Designer
[CO Adaptive Architecture](#)

Builder
LB General Construction

Mechanical Engineer
[ABS Engineering](#)

Structural Engineer
[Nate Bergen, PE](#)

Passive House Consultation
[475 Building Supply](#)
[Bldgtyp](#)





The three-story townhome had some beautiful woodwork and plaster detailing, which they took care to preserve or duplicate. The building was gutted, with the cellar being dug out to accommodate installing 4 inches of XPS beneath the slab and on the surrounding walls of a core conditioned area. Unconditioned cellar spaces on either side of that core are accessible by cellar hatches in the front and rear of the building.

Once gutted, the interior brickwork was repointed, and all the joist pockets were sealed and remortared. A fluid-applied, vapor-permeable membrane was used to air seal the front and back walls, and an intelligent air and vapor barrier membrane was installed throughout the interior envelope. The R-33 exterior walls were insulated with dense-packed cellulose.

On the front south-facing façade, motorized shades have been added to the new triple-pane, aluminum-clad wood-framed windows to cut summer heat gain. The shades significantly reduced the projected cooling demand in the Passive House energy model.

To eliminate gas-related safety concerns and hopefully achieve a net zero energy residence, all the appliances are electric and a 5.76-kW PV system was added to the roof. An ERV supplies continuous ventilation and a variable refrigerant flow heat pump system provides heating and cooling. Even their car runs on electricity, refueled by a charging station installed in the front yard.



Products

Doors

[Klearwall](#)

Air/Moisture Control

[Pro Clima from 475](#)

[Sto](#)

Insulation

[CompacFoam from 475](#)

[Rockwool](#)

Skylights

[Lamilux from 475](#)

Exterior Shades

[Hella from Peak](#)

Photos by Peter Dressel

Passive House Metrics

Specific space heating demand	1.5 kBtu/ft ² /yr	4.7 kWh/m ² /yr
Specific space cooling demand	3.8 kBtu/ft ² /yr	12 kWh/m ² /yr
Source energy use intensity (EUI)	41.8 kBtu/ft ² /yr	131.9 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	

Gramercy Park ENERPHIT Townhouse

New York, New York

Most first-time Passive House projects are modest. The Gramercy Park townhouse started out as a relatively straightforward, high-performance remodel. However, after partners In Cho and Timothy Shields received a late evening phone call from their client, things changed. The client wanted to add a new floor to this four-story townhouse. That triggered a set of structural changes that significantly increased the scope of work. Essentially they had to completely gut the interior, including floor joists, and build a new building within a building.

Since the building needed to be seriously deconstructed, ChoShields thought it only made sense to pursue a Passive House EnerPHit component certification. Because the original design was very energy efficient anyway, adding a few items to reach Passive House certification didn't increase costs significantly. Savings from the downsized mechanical systems generally offset those costs.

The floor addition and all the intermediate floors had to be framed in steel, introducing potential thermal bridges. Fire code required the use of lightweight steel framing in other parts of the building. The complexity of the construction, coupled with the fact that it was the first Passive House project for ChoShields, meant that the partners spent a lot of time

researching materials and components. Each selection had to satisfy three distinct needs: structural engineering requirements, complying with the fire codes, and minimizing thermal bridging.

The project, which was just certified, used many construction types: wood framing, historic masonry, poured-in-place concrete, light-gauge steel, and structural steel. The work scope included excavating and pouring new footings, building secondary walls within the party walls, adding a 5-foot extension in the rear, and adding a fifth floor. In addition to the thermal-bridging issues, tying together the old and new parts of the building presented air-sealing challenges.

This project was definitely a team sport. Cho and Shields both relied heavily on the local and international Passive House communities in finding answers to

Team

Architect and Certified Passive House Consultants
[ChoShields Studio](#)

Builder
[Eagle Contractors Group](#)

Interior Fit Out
[Diesel Contracting of NY](#)

Mechanical Engineer
[Baukraft Engineering PLLC](#)



their questions. They had to work very closely with the structural engineer, the builder, and the trades throughout the project. Their builder had never built a Passive House before, so he needed to be educated about Passive House principles. He's now planning on remodeling his own home to Passive House standards.

And the client? Very happy. According to her, "You're always comfortable, and it's healthy air. That's huge."

Products

Windows & Doors
[Kleanwall](#)

Air/Moisture Control
[Sto](#)

Structural Thermal Breaks
[Schöck](#)

Water Heating
[Sanden](#)

Skylights
[Lamilux from 475](#)

Photos by Chuck Baker Photography

Passive House Metrics

Specific space heating demand	6.6 kBtu/ft ² /yr	20.8 kWh/m ² /yr
Specific space cooling demand	2.9 kBtu/ft ² /yr	9 kWh/m ² /yr
Source energy use intensity (EUI)	38.9 kBtu/ft ² /yr	122.6 kWh/m ² /yr
Air changes per hour	0.38 ACH ₅₀	



Hunter's Point HISTORIC Townhouse Retrofit

Queens, New York

The Hunters Point historic district in Long Island City contains a small cluster of townhouses originally built in the late nineteenth century. The area has gone through several economic cycles, and many of these homes were converted along the way to two- and three-family residences. The owners of one of these townhouses contacted architect Scott Henson to renovate their Greek revival-style brick building, resurrecting its single-family status while adding square footage to the rear and setting Passive House as an overall project goal. Henson's firm specializes in historic preservation.

Team

Architect and Passive House Designer

[Scott Henson Architect](#)

Certified Passive House Consultant

[Baukraft Engineering PLLC](#)

The house had been divided into three apartments, with small rooms and not much of the original detailing. Striving to find a balance between old and new, this gut renovation will open up rooms to allow daylight to reach further into the interior, while salvaging historic details. Henson and his team will be researching and replicating some of the missing decorative trims and bases, ceiling medallions, and architectural detailing on doors, windows, and stairs.



The front façade will be restored, with triple-pane simulated double-hung windows replacing the current vinyl-clad units. There are no Passive House-quality entrance doors that resemble the original, so the airtightness layer will wrap around the inner vestibule door, allowing a replica of the exterior door to grace the front.

Because the back of the building is not subject to historic district restrictions, an artist's studio will be added at the garden level. A lift-and-slide door will bring light into the south-facing studio, which will be

partially shaded by an overhang to reduce summertime heat. A new bulkhead and terrace area on the roof will be set back so that they aren't visible from the street. The sidewalls toward the back of the townhouse will be wrapped in an exterior insulation and finish system and a stucco finish. Meanwhile, the rear-facing garden, parlor, and bulkhead level façades will feature a rain screen underneath the shou sugi ban siding. On the second story the original brick wall with its bluestone sills and lintel will be preserved.

"Our work in preservation is the most sustainable thing you can do with an old building," says Henson, "and adding Passive House certification to the project goals can only increase the value of the building." He is looking forward to bringing the Passive House approach to much more of his firm's historic preservation work, from townhouses to skyscrapers.

Products

Windows

[Zola](#)

Doors

[Bildau & Bussmann](#)
by [Eco Supply](#)

Insulation

[InSoFast](#)

Rendering and photo by Scott Henson Architect

Passive House Metrics

Specific space heating demand	5.4 kBtu/ft ² /yr	17 kWh/m ² /yr
Specific space cooling demand	3.8 kBtu/ft ² /yr	12 kWh/m ² /yr
Source energy use intensity (EUI)	27.7 kBtu/ft ² /yr	87.4 kWh/m ² /yr
Source energy use intensity (EUI) (renewable)	13.4 kBtu/ft ² /yr	42.3 kWh/m ² /yr
Air changes per hour	1.0 ACH ₅₀ (design)	

A Brownstone REVIVAL

New York, New York

“Bringing 2018 technology to this 1918 building that has beautiful architectural aspects has been quite a rewarding project,” says Clemens von Reitzenstein, principal of Brace Enterprises, whose company was hired to do a Passive House retrofit on this 100-year-old brownstone.

Passive House is a no-brainer for townhouse renovations, he explains, because most of the time there are only two exterior walls that require superinsulating. The party walls generally are not insulated, other than for acoustic reasons, because it is assumed that neighbors will maintain a conditioned environment in their spaces. The cellar can be, and was here, the exception to this rule, as there is no guarantee that the neighbors will heat their cellars. All four of the cellar walls are insulated with 2 inches of XPS.

Bringing the cellar into compliance with contemporary codes meant digging down to achieve a minimum overall height of 7 feet 6 inches. First, though, von Reitzenstein requested that a structural engineer be consulted to avoid compromising the existing building foundation. The structural engineer stipulated that the excavation should cease 18 inches from the foundation, so Brace built a reinforced concrete

ledge to protect the foundation. Brace then installed a vapor barrier membrane and 3 inches of XPS insulation below a new steel-reinforced cellar slab.

The existing four floors above were gutted, and the brick party walls were parged with a cement, hydrated lime, and sand mix, and coated to improve their airtightness. An intelligent membrane is being installed in the front and back exterior walls, which are then being insulated with blown-in cellulose. To prevent thermal bridging, a full-height, 3-foot-width layer of XPS is being installed at the junction of the party and exterior walls. The old windows are being replaced with triple-pane units.

As plans for the building include creating two residences, the heating, cooling, and ventilation systems were designed to ensure individualized comfort. Heating and cooling are being supplied by mini-split heat pump systems, with four air-handling units—one on each floor—and two compressors. Two ERVs will provide constant fresh air and help control humidity. A heat pump water heater will provide water heating for the whole building.

Team

Builder

[Brace Enterprises, LLC](#)

Architect

[Downtown Designworks
Architecture, PLLC](#)

Consulting Architect

[Duncan Architect, PLLC](#)

Certified Passive House Consultant

[Baukraft Engineering PLLC](#)



According to von Reitzenstein, whose company normally performs high-end retrofits, the Passive House features are not as complicated or costly as some might fear. A client could easily spend more on finishes. “Given the same budget, instead of more expensive finishes, I would rather put that money into a Passive House, because it further increases the equity value of the property and you live in a healthier and more comfortable environment,” says von Reitzenstein—a choice the owner of this beautifully restored brownstone clearly supports.

Photos by Clemens von Reitzenstein

Passive House Metrics

Specific space heating demand	5.3 kBtu/ft ² /yr	16.8 kWh/m ² /yr
Specific space cooling demand	5.6 kBtu/ft ² /yr	17.7 kWh/m ² /yr
Source energy use intensity (EUI)	24.1 kBtu/ft ² /yr	76.1 kWh/m ² /yr
Source energy use intensity (EUI) (renewable)	11.7 kBtu/ft ² /yr	36.8 kWh/m ² /yr
Air changes per hour	1.0 ACH ₅₀ (design)	

Products

Windows & Doors

[Zola](#)

Air/Moisture Control

[Pro Clima from 475](#)

[Sto](#)

Water Heating

[Sanden](#)

Bronx

SINGLE-FAMILY ENERPHIT

Bronx, New York

Like most other homes in this working-class neighborhood, this modest 1,800-ft² single-family masonry home, built in 1948, has no insulation.

When the current owners bought it, it was wrapped in vinyl siding. They decided to undertake a gut remodel that focuses on good use of space, comfort, and resiliency. Targeting the EnerPHit component standard for the retrofit seemed like the obvious, logical choice.

Current New York City building code allows for adding up to 4.8 inches of insulation to the exterior of a home. That's great, but also impossible in many parts of New York City because of zero lot lines. Fortunately, in the Bronx local zoning requires front, back, and side yards—a bonus for anyone executing a Passive House retrofit.

This house's side yards make it easy to wrap the walls in what architect Lindsay Klein calls a 4-inch sleeping bag of rigid insulation once the vinyl siding is

Team

Architect

[Lindsay Architecture Studio, P.C.](#)

Certified Passive House

Consultant and

Mechanical Design

[Building Type, LLC](#)

Structural Engineer

[Thornton Tomasetti](#)

Builder

[Minch Construction Corporation](#)

removed. A liquid-applied air barrier will be placed under the insulation directly on the existing masonry wall, with a stucco finish coat over the insulation. The deteriorated asphalt shingle roof will be removed and replaced with 6 inches of polyisocyanurate insulation above the rafters, then reroofed.

Local zoning also requires off-street parking provided by a garage—a less-helpful regulation. Unsurprisingly, many neighborhood garages, including this one, were converted to living spaces or hybrid spaces that can accommodate a parked car when a serious storm threatens. The local building department is requiring that the garage be turned back into a parking space, stealing precious interior square footage.

Klein plans to restore the garage, to function as parking or a kid's playroom. It will have a one-hour fire-rated separation from the rest of the living spaces and a pair of high-quality carriage doors at the driveway. Klein likens it to a carriage house outfitted as interior, usable space but carefully isolated thermally and airtight from the rest of the home. It just so happens that a car can be parked there if necessary. The floor will be reinforced where tire treads would normally run.

The project team has strong Passive House experience. The builder has never built a Passive House, but he is very experienced and interested. As Klein points out, there will be very few new penetrations in the shell, so air sealing should be straightforward. The insulation sleeping bag shouldn't require any special attention. So motivation will likely supersede inexperience, leading to a successful wrap-up of this neighborhood EnerPHit project.

Products

Windows & Doors

[Wythe](#)

Air/Moisture Control

[Sto](#)

Insulation

[Sto](#)

Water Heating

[Sanden](#)

Skylights

[Fakro from 475](#)



Rendering by Lindsay Klein

Passive House Metrics

Specific space heating demand	19.1 kBtu/ft ² /yr	60.2 kWh/m ² /yr
Specific space cooling demand	3.2 kBtu/ft ² /yr	10 kWh/m ² /yr
Source energy use intensity (EUI)	75.1 kBtu/ft ² /yr	237 kWh/m ² /yr
Air changes per hour	1.0 ACH ₅₀ (design)	

2nd Street Prefab DUPLEX

Troy, New York

Many parts of the country have large sections of older workforce housing in need of updating or repair. Troy, New York, is one such place. The neighborhood surrounding 2nd Street is dotted with modest two-story homes built in the 1890s. Recent appraisals value the houses in the \$75,000 to \$150,000 price range. The area is just a few blocks from the Hudson River in a location that is prone to flooding.

Where some people see a neighborhood in disrepair, Cycle Development, a sister company to Brooklyn's Cycle Architecture + Planning, sees an opportunity. It's in the schematic design stage for a prefabricated duplex Passive House that fits into the typically narrow 2nd Street lots. Current plans call for two stacked two-bedroom homes of approximately 1,000 square feet, situated on a 25-foot by 135-foot lot.

Cycle believes that Troy is undergoing a renaissance, exemplified by the vigorous 2nd Street corridor. The compact downtown is within walking distance of the project's building site. A variety of local colleges have drawn a vibrant young population to the city. Most importantly, there is strong local support for energy-efficient and resilient rejuvenation, especially Passive House building. Cycle sees this as an opportunity to demonstrate that it's possible to build affordable workforce-priced Passive Houses, and at the same time actively participate in the community's development. It sees its approach as a model that can be scaled to other similar communities.

One key to the affordability issue is prefabricated construction. The building is a simple rectangle. The walls and roof, constructed of cross laminated timber, are clad in 10 inches of rigid insulation. The metal skin will be held in place by fiberglass clips. Each unit has a central service core containing the bathroom and kitchen. The walls, roofs, and service cores will be constructed off site and shipped to the site for assembly on a preformed foundation. Because the house is located in a flood zone, it has to be raised up almost 6 feet above grade on cast concrete piers. Front and rear decks and entrances will be field constructed.

The project is still in the conceptual stage, and many issues and details have yet to be worked out. One issue is very clear for Cycle—this development is a community effort. Cycle is engaged in extended discussions with local planning and building officials, and is focusing on hiring local trades and suppliers, even though they may lack Passive House experience. Having participated in the NYC Build It Back program after Hurricane Sandy, the firm is dedicated to providing affordable, resilient housing.

Team

Owner

Cycle Development

Architect

Cycle Architecture + Planning

Engineer

OSD Structural Engineering



Products

Windows

Klearwall

Rendering by Cycle Architecture

(Preliminary) Passive House Metrics

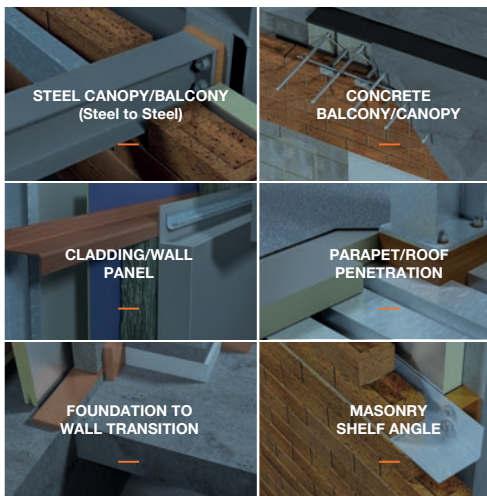
Specific space heating demand	4.75 kBtu/ft ² /yr	15 kWh/m ² /yr
Specific space cooling demand	4.75 kBtu/ft ² /yr	15 kWh/m ² /yr
Source energy use intensity (EUI)	38 kBtu/ft ² /yr	120 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀	



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Two-Family ROW HOUSE Renovation

Brooklyn, New York

This revitalization of a historic Park Slope masonry townhouse is making full use of its existing assets, while dramatically elevating its performance and creating new value. The rear façade will be opened to sun and greenery, and a rooftop clerestory window will bring sunlight nearly to the front door. Putting unused zoning areas to use, a new third floor and a deeper cellar are being constructed.

Rendering by Ryan Enschede Studio

Team

Architect
[Ryan Enschede Studio](#)

Certified Passive House Consultant
[Baukraft Engineering PLLC](#)

Structural Engineer
Barry Structural Engineering, PLLC
[—mike@barrystructural.com](mailto:mike@barrystructural.com)

Passive House Metrics

Specific space heating demand	4.7 kBtu/ft ² /yr	14.8 kWh/m ² /yr
Specific space cooling demand	5.5 kBtu/ft ² /yr	17.4 kWh/m ² /yr
Source energy use intensity (EUI)	34 kBtu/ft ² /yr	107 kWh/m ² /yr
Air changes per hour	1 ACH ₅₀ (design)	

Oak Street ENERPHIT

Brooklyn, New York

For this EnerPHit remodel in Brooklyn's Greenpoint neighborhood, Caliper Studio essentially gutted the building, which is located one block from the East River. Navigating a fairly tight budget and New York City's stringent flood zone requirements, the architects were able to preserve much of the building's existing structural components.

Team

Architect

[Caliper Studio Architecture](#)

Builder

[MSquare Builders](#)

Certified Passive House Consultant and Mechanical Design

[Baukraft Engineering PLLC](#)



The 2,238-ft² building, originally workforce housing, has two stories plus a habitable basement. The remodel retained the front brick façade, although the paint was removed. An awkward extension at the rear of the building was torn down, and the conditioned space was extended 5 feet past the original back wall. The roof was removed and rebuilt, and a bulkhead for roof access was added to the conditioned space.

The bulkhead serves another key function—housing all the mechanical equipment that has to be located above the floodplane. It contains an ERV and a sealed-combustion on-demand gas water heater. Supplemental heating and cooling is provided by a mini-split heat pump with ducted units on all three floors.

Flood zone restrictions prevented the builder from excavating the basement below the current level, retaining the 7-foot ceiling height. The existing slab was removed, horizontal and vertical-edge rigid insulation was installed, and a new slab was poured at the original grade. The subslab vapor barrier was wrapped up the interior walls and taped to a wall air barrier membrane. This membrane continues up the interior, then wraps to the outside at the roof.

The front wall was insulated with 5-1/2 inches of blown-in cellulose, covered by the air barrier and topped with 2 x 3 horizontal battens forming a utility chase. The party walls were air sealed with a parge coat and topped with a liquid-applied membrane, but left uninsulated. New walls at the rear were insulated with 6 inches of exterior mineral wool under their rain screen. The interior air barrier for the new footings wraps across their top to join the exterior air barrier under the mineral wool.

Because Caliper Studio also does metal fabrication, it will be providing some custom metalwork for the house, including door handles, some rain screen components, and other interior trim. These items should be excellent additions to a compact, cozy Passive House near the Brooklyn waterfront.

Products

Air/Moisture Control
[Sto](#)

Ventilation
[Zehnder America](#)

Insulation
[Rockwool](#)

Skylights
[Lamilux from 475](#)

Rendering and photo courtesy of Caliper Architecture

Passive House Metrics

Specific space heating demand	2.8 kBtu/ft ² /yr	8.7 kWh/m ² /yr
Specific space cooling demand	7.8 kBtu/ft ² /yr	24.7 kWh/m ² /yr
Source energy use intensity (EUI)	21.3 kBtu/ft ² /yr	67.3 kWh/m ² /yr
Air changes per hour	1 ACH ₅₀ (design)	





Caliper STUDIO

Brooklyn, New York

This Caliper Studio is a unique architectural practice housed in a building that reflects the firm's somewhat unusual offerings: the full range of architectural services and custom metal fabrication. Its 2,600-ft² Passive House office is tucked into one corner of a building devoted to a 14,500-ft² fabrication warehouse.

Team

Architect

[Caliper Studio Architecture](#)

Builder

[Bluestone Studio](#)

Certified Passive House Consultant

[Baukraft Engineering PLLC](#)

The original building shell consisted of an 8-inch unfinished masonry wall with a slab floor and wooden ceiling joists supported by large steel beams. The building's retrofit started with installing standard 2 x 4 interior partitions separating the office from the warehouse. The whole interior was then wrapped in mineral wool—6 inches on the partition walls and 8 inches on the exterior walls, for R-values of 27 and 35 respectively. The mineral wool was temporarily held in place with vertical strings while an air barrier membrane was stretched from the floor to the ceiling.

Steel studs were then erected on top of the membrane, creating a service cavity that tied the wall air barrier to the existing slab floor. This intersection required meticulous detailing so as not to penetrate the wall membrane. A new slab insulated with 3 inches of rigid insulation was poured over the existing slab.

At the ceiling, the air barrier was wrapped behind the steel beams where they run parallel to the wall. In the other direction, where the beams intersect the walls, the membrane was wrapped around the beams and connected to the roof membrane. To prevent air leakage at the beam-wall intersections, the beams were taped their entire length where they met the membrane. The roof was covered in rigid foam, and the ceiling joists were filled with mineral wool for an overall R-value of 56.

The office has triple-pane Certified Passive House windows in the exterior walls, and two large skylights on the roof. Being a metal fabrication shop, Caliper fabricated custom skylight enclosures. After installation, they were wrapped in rigid foam insulation and then topped with rain screen cladding. The air barrier was extended from the ceiling up to the enclosure bottoms and taped.

The finished space is outfitted with dual mini-split heat pumps and an ERV for ventilation. Blower door testing and infrared inspections completed the project team's evaluation. For a square footage cost of roughly \$175, with approximately 8% spent on Passive House specifics, Caliper Studio now has a comfortable, quiet office space located next to its metal fabrication shop. The company embodies an interesting juxtaposition—an architectural firm that fabricates using a high-thermal-bridging material for inclusion in low-thermal-bridging buildings.

Products

Windows

[Intus](#)

Doors

[Klearwall](#)

Air/Moisture Control

[Pro Clima from 475](#)

Ventilation

[Zehnder America](#)

Photo by Ty Cole

Passive House Metrics

Specific space heating demand	3.78 kBtu/ft ² /yr	11.9 kWh/m ² /yr
Specific space cooling demand	2.48 kBtu/ft ² /yr	7.8 kWh/m ² /yr
Source energy use intensity (EUI)	37.5 kBtu/ft ² /yr	118.3 kWh/m ² /yr
Air changes per hour	0.35 ACH ₅₀	

A COMMERCIAL-SCALE Retrofit

Brooklyn, New York

After a comprehensive Passive House retrofit, a 90-year-old concrete and brick structure is now the 21,000-ft² office for the NoVo Foundation, whose work includes a focus on empowering girls and women around the world. The foundation required that the construction workforce for this retrofit had to include at least 25% women. Through the client's proactive commitment to its core values, vigilant oversight, and clear implementation process, the percentage of women on the jobsite ranged from 25% to 35%.

In redesigning the building, Ryall Porter Sheridan's primary aim was to deliver an elegant and environmentally friendly working environment that still harmonized with the neighborhood's residential character. The project retained the shell of the existing three-story building, but removed the roof and added a new story. The interior was gutted, except for the concrete columns and floor slabs. In addition to the foundation's offices, the building now houses an open welcoming lobby, flexible meeting rooms, and a roof terrace for events.

When it came to superinsulating the shell, this building's tight fit on two sides called for a mix of interior and exterior approaches. On all façades, 12 inches of cellulose fill an interior cavity, adding up to an R-48. An exterior insulating and finish system (EIFS) with 5 inches of rigid insulation is providing a continuous R-20 layer to those façades that aren't right up against the property line. To prevent internal condensation where the exterior EIFS can't fit, the architects specified a fluid-applied thermal break aerogel product sprayed on the interior surface of the structural walls. An intelligent, vapor-permeable air barrier membrane allows the assemblies to dry toward the interior.

To efficiently meet cooling loads and give occupants control of temperatures in their areas year-round, heating and cooling are being supplied by a zoned system of 14 heat pumps that each have coupled water-to-air heat exchangers, increasing the efficiency of the heat pumps. In winter, the heat exchangers are fed by warm water from the highly efficient condensing boiler; in summer a rooftop cooling tower supplies cooled water to the exchangers. A commercially sized HRV delivers continuous fresh air.



Team

Architect

Ryall Porter Sheridan Architects



Designed to meet EnerPHit comfort and efficiency standards, the building deftly incorporates other well-being features. To encourage walking between floors, the stairs are more spacious than required by code and daylit, with well-placed artwork chosen to promote inspiration. The south-facing façade is adorned with mature deciduous trees. This work-and-convening environment stands as an active expression and living model of the foundation's vision for a more just and balanced world.

Renderings by Ryall Porter Sheridan Architects

Products

Air/Moisture Control
Sto

Ventilation
Zehnder America

Insulation
Rockwool

Passive House Metrics

Specific space heating demand	7.1 kBtu/ft ² /yr	22.4 kWh/m ² /yr
Specific space cooling demand	4.7 kBtu/ft ² /yr	14.8 kWh/m ² /yr
Source energy use intensity (EUI) (renewable)	17.6 kBtu/ft ² /yr	55.5 kWh/m ² /yr
Air changes per hour	1.0 ACH ₅₀	

Designing a GAME CHANGER

New York, New York

“The House at Cornell Tech is our answer to the call for making big and meaningful change to combat global warming,” says Deborah Moelis, Handel Architects’ project manager for the unquestionably groundbreaking 26-story academic residence on Roosevelt Island. Handel’s Blake Middleton was the lead designer for The House, which includes over 200,000 square feet of housing, lounge areas, a fitness room, and other amenity spaces. The House was developed by The Hudson Companies and The Related Companies, for Cornell Tech, with Steven Winter Associates (SWA) acting as the Passive House consultant.

“The design challenge was multifaceted,” says Middleton. First, no one had attempted a residential Passive House building of this scale before; at that time it was the world’s tallest Passive House building, although contenders are rising. Second, the site—in the middle of the East River—is highly visible from the eastern edge of Manhattan and from Queens, raising the bar for the project’s architectural expression. The House is also a marker for the new Cornell Tech campus, its version of a campanile.

The Passive House goals affected the amount of glazing, which, coupled with a tight budget to keep the rents affordable for students, limited the opportunity for an elaborate exterior. “Working within these rules, the solution we came to was a building that strongly expresses what it is,” says Middleton. “Quickly we conceived of the idea of creating this thick, highly insulated wrapper around the building. Instead of fighting the thick wall, we embraced it.”

What they came to call The Wrap became the conceptual foundation for the exterior wall. The Wrap is peeled up from the foundation to expose the two-story lobby space, with its floor-to-ceiling windows looking out at the East River. On the residential floors, the windows, which vary in size because they were optimized to conform with the layout of the residences, form deep incisions in The Wrap. “These horizontal bands of glass and dark metal became the signature of The Wrap,” says Middleton.

Realizing these ideas was incredibly complex. “Our team had to research and oversee the implementation of a host of new products, procedures, and innovative details,” Moelis says. “Keeping the project on time and on budget required a major coordination effort, with constant communication of Passive House requirements to numerous agencies, contractors, 19 consultants, and three clients.”

Even with this complexity, Moelis emphasizes that integrating Passive House requirements into a building’s design is within the range of what architects

Team

Owners

Cornell Tech

The Hudson Companies, Incorporated

The Related Companies, L.P.

Architect

Handel Architects LLP

Passive House, LEED Consultant

Steven Winter Associates

Construction Manager

Monadnock Construction Incorporated





typically do. “We incorporate program into projects,” she stresses. She took the training to become a Certified Passive House Designer and now enthuses about its relevance. “Passive House is a game changer for how all buildings can be designed,” she says.

The House’s high-performance skin has an overall R-value of 19 with 23% glazing. The walls were built using a custom prefabricated metal panel system—averaging 30 feet long by 9 ½ feet high—with windows inserted and sealed in the structure. The panels had several advantages: cost-effectiveness, better quality control in the factory, and faster on-site installation. Keeping those panels attached to the framing required 123 anchors on each floor, with each anchor having to be insulated and air sealed.

Making this high-rise airtight was a major challenge, especially with a construction crew new to Passive House. Monadnock, the construction management firm, preemptively hired a consultant to train all the subcontractors. The contractor developed procedures specific to the project to ensure that the vapor barrier was continuous and airtight throughout the project. Ultimately this supertight building scored a remarkable 0.14 ACH₅₀ on the final blower door test—a testament to the project’s superior construction and quality control.

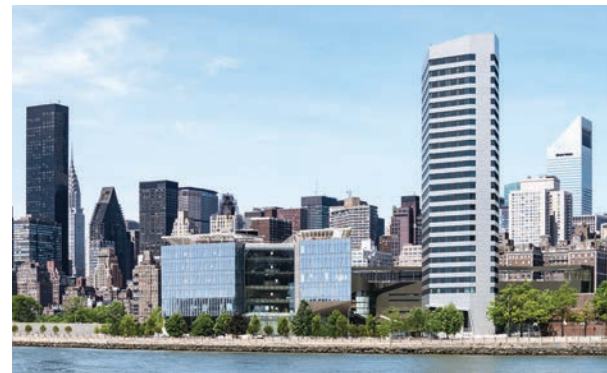
During concept design, it took the team months to resolve which ventilation and heating-and-cooling system would be optimal and not bust the building’s energy budget. It ultimately chose a centralized ventilation system with two customized, large rooftop ERVs. Each apartment enjoys a constant supply of fresh filtered air. The stale air exhausted from the kitchen and toilet is commingled at the top of the building—a solution that required a code variance. “That was a huge deal,” says Moelis, “and now everyone after us can use that approval.”

For heating and cooling, the team opted for a low-energy variable refrigerant flow system. The condensers sit on thermally broken balconies off the side of the building.

Each condenser pushes refrigerant to a set of evaporators on two half-floors, with individual evaporators in each living room and bedroom. This arrangement optimizes the system’s efficiency and flexibility, allowing for the possibility of delivering heating to rooms on the north side while simultaneously supplying cooling to those on the south.

Finding doors for the 23 thermally broken balconies was another serious challenge, and to be safe the team opted for expensive, high R-value refrigerator doors. They served their purpose but were difficult to install, are unsightly, and can’t be locked. Having now become more confident of the approaches and trade-offs that can be used to meet Passive House targets in very large buildings, Moelis says Handel will be specifying less costly, lower R-value doors in the next project.

The House is a groundbreaking example of sustainable architecture. Indeed, the entire team regards this project as a successful beta test to meet its moral imperative to combat global warming by minimizing the carbon footprint of buildings, Moelis says.



Photos by Field Condition

Products

Air/Moisture Control
Pro Clima from 475

Insulation
Rockwool

Structural Thermal Breaks
Schöck

Façade System
Knight Wall Systems

Passive House Metrics

Specific space heating demand	4.67 kBtu/ft ² /yr	14.7 kWh/m ² /yr
Specific space cooling demand	3.17 kBtu/ft ² /yr	10 kWh/m ² /yr
Source energy use intensity (EUI)	38.2 kBtu/ft ² /yr	120 kWh/m ² /yr
Air changes per hour	0.14 ACH ₅₀	



WINDOWS AND DOORS

Schuco AWS75 by
European Architectural Supply, LLC

ARCHITECT

Chris Benedict, RA

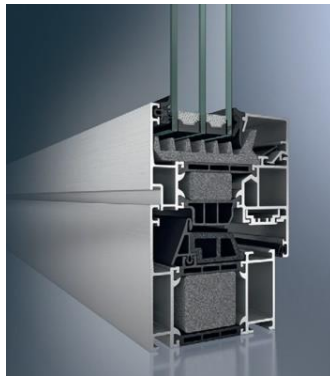
DEVELOPER

Synapse Development Group

Multi-unit Passive House Window Installation

European Architectural Supply, LLC supplied and installed windows for the largest multi-unit Passive House project in Manhattan. The company managed the project from design through manufacturing, delivery and installation.

Scheduled for completion in 2016, Perch Harlem is among the largest Passive House projects in the US. Chris Benedict, the project architect, brought EAS on board to explore the possibility of using Schuco thermally-broken aluminum windows for this seven story multi-unit PH project. The design called for floor-to-ceiling windows, with the largest reaching 8x8ft. The architect selected Schuco AWS75.SI+ aluminum window system for its thermal performance and cost per square foot.



Full-Service Passive House Windows Procurement, Delivery and Installation

EAS differentiates itself among window suppliers by offering full service procurement of windows from design through delivery, installation and after-sale service. This project involved 21 tons of triple-pane windows with largest window units weighing 620lbs each. The EAS staff coordinated the delivery and unloading of windows before the building was enclosed to enable easy placement of 6,000lbs pallets on the individual floors. The OSHA-certified EAS installation staff worked with the General Contractor to stage the window installation in a manner to provide maximum weather protection as the building's walls were erected during the winter months.



European Architectural Supply, LLC
sales@eas-usa.com
www.eas-usa.com
(781) 647-4432



Corona SENIOR Residence

Corona, New York

The Hellenic American Neighborhood Action Committee (HANAC) is a multiservice agency serving over 25,000 individuals with diverse programs and services, including the development and operation of energy-efficient and affordable housing for low-income seniors. Following Superstorm Sandy, HANAC decided to construct a building whose resilience and engineering design would maximize the potential for tenants to shelter in place during power outages or extreme weather events, reducing the adverse impacts on comfort and health that vulnerable populations can experience during relocation.

The 68-unit Corona Senior Residence, scheduled for completion in 2018, is HANAC's first such development to pursue Passive House certification, both to drive down energy use and costs and to advance these client-centered goals. The

Team

Architect

[Think! Architecture and Design](#)

Passive House and Energy Program Consultants

[Association for Energy Affordability \(AEA\)](#)

[Duncan Architect](#)

Mechanical Engineer

[New York Engineers](#)

project is set back from the street and designed with façade materials that help it to fit into a block that also includes low-rise residential properties. It will welcome and serve the surrounding community with a 5,000-ft² ground floor prekindergarten program.

The building is a cast-in-place concrete structure with an exterior rain screen and an exterior insulation and finish system (EIFS) façade. The building features individual ERVs in each of the apartments, central HRVs for the common areas, a variable refrigerant flow (VRF) heating-and-cooling system, condensing boilers for domestic hot water, and high-performance triple-pane windows.

The Association for Energy Affordability (AEA), as Passive House Consultant, worked closely with the developer, the design team, the NYC Department of Housing and Preservation and Development, the NYC School Construction Authority, NYSERDA, and financial partners to help all parties understand how the Passive House features of the building would interact with the standard specifications for structures they fund, so that all energy and

regulatory objectives would be met. AEA also provided timely on-site training to the general contractor to help its installers understand the Passive House-related project details and the impact these would have on the work they would perform. Such training reduces the risks of costly rework or other delays, ensuring the project's ability to meet its aggressive energy goals.

Products

Windows & Doors

[Intus](#)

Air/Moisture Control

[Siga](#)

Ventilation

[Swegon](#)

[Zehnder America](#)

Insulation

[Rockwool](#)

Structural Thermal Breaks

[Schöck](#)

Photo courtesy of The Association for Energy Affordability, Inc.

Passive House Metrics

Specific space heating demand	2.9 kBtu/ft ² /yr	9 kWh/m ² /yr
Specific space cooling demand	3.5 kBtu/ft ² /yr	11 kWh/m ² /yr
Source energy use intensity (EUI)	38.0 kBtu/ft ² /yr	120 kWh/m ² /yr
Air changes per hour	0.3 ACH ₅₀ (design)	



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Columbia CONDOMINIUMS

Brooklyn, New York

The reasons for the quick sale of the 13 condominiums at 255 Columbia aren't hard to find. While a great location is always an inducement, the built-in comfort, efficiency, and superior air quality made these two-, three-, and four-bedroom units irresistible. It's rare that a residence includes a constant supply of filtered fresh air, thanks to individual ERVs, barely perceptible street noise, and a pittance of a utility bill for heating and cooling. And, then there are the outdoor spaces—a 2,000 ft² common garden and private outdoor spaces for each unit in this 7-story building—generous amenities in a city that defines urbanism.

The front 10-ft by 18-ft terraces, which face south-southwest, serve as green retreats and provide an important Passive House-related function: each shades the unit below. They were also a classic Passive House challenge, requiring the use of thermally broken connectors to stop the thermal bridging and potential heat loss at the points where the terraces are joined to the main building structure.

The site's poor soil quality added to this development's construction challenges. In order to hit minimum soil-bearing capacity, ground compaction was needed. To lessen the building's weight, the structure started with a medium-gauge, steel framing system that was manufactured off-site. The wall panels were sheathed, air sealed, and water proofed, before being trucked to the site. Exterior walls that abut neighboring buildings are insulated with 2 inches of XPS, and a 6-inch exterior insulation and finishing system (EIFS) was applied to those walls that are exposed to the elements.

A reclaimed wood canopy creates a warm welcome to the small lobby, dominated by a green living wall—a tribute to the building's low energy design. Each apartment features large triple-pane windows, individually controlled heating and cooling supplied by mini-split heat pumps, and many designer touches. Several residences have dramatic views of Manhattan and the New York Harbor.

Team

**Project Manager/
Owner's Representative**
[JBS Project Management](#)

Architect
[Loadingdock5](#)

Construction Management
[KSK Construction](#)



Products

Windows & Doors
[Yaro](#)

Air/Moisture Control
[Sto](#)

Insulation
[Rockwool](#)

**Structural Thermal
Breaks**
[Schöck](#)



Photos courtesy of JBS Project Management

Passive House Metrics

Specific space heating demand	3.2 kBtu/ft ² /yr	10.0 kWh/m ² /yr
Specific space cooling demand	2.9 kBtu/ft ² /yr	9.0 kWh/m ² /yr

DeKalb COMMONS

Brooklyn, New York

DeKalb Commons is an affordable Passive House housing development in the Bedford Stuyvesant neighborhood of Brooklyn. Currently in schematic design, the project consists of two seven-story, multifamily buildings across DeKalb Avenue, and one four-story building with ground floor commercial space and apartments above. Although project architect Magnusson Architecture and Planning (MAP) has incorporated many Passive House strategies in past projects, this is its first project that will pursue certification, for the two larger buildings.

MAP designed the community spaces with an eye to improving the quality of life for the tenants and community members. The ground floor daylight

Team

Architect

Magnusson Architecture
and Planning

Builder

Galaxy Construction

Certified Passive House

Consultant

Bright Power

MEP Engineers

Dagher Engineering

Owner

St. Nicks Alliance

community space will improve community safety by putting eyes on the street. A planted buffer space at grade will mitigate street noise and provide privacy for the ground floor units. The planted rear yard will have seating, and a play area for children. Active Design Guidelines inform circulation throughout the building, and open-space design encourages residents to be physically active and spend time outdoors.

The integrated project team kicked off within two weeks of the start of schematic design. All team members have at least some familiarity with Passive House concepts, or net zero construction. Certain modeling and design issues are still being refined. As with other large multifamily Passive House buildings, the cooling loads are expected to predominate.

Air sealing of the concrete masonry unit (CMU) building will require some detail work. Although the building form is a rectangle, potential problem areas include elevators, trash chutes, and exterior doors. Another unresolved issue is the building cladding. The CMU walls will be covered with 8 inches of exterior mineral wool attached with a fiberglass Z girt system that minimizes thermal bridging. The façade can be a panelized system or an exterior insulation and finish system (EIFS). Brick finish is expensive and awkward to install on top of thick exterior mineral wool. EIFS is generally considered less durable than the other options. The project team is currently evaluating all these choices.

The building team is encountering an issue related to a recent New York City code change: Ventilation louvers have to be Class A rated for wind and rain. The smallest commercial louver that meets that requirement is 12 inches across, limiting ventilation design choices. These louvers also have to be separated a certain distance from operable windows. This size is also intrusive structurally and aesthetically. These obstacles could rule out putting an ERV, which requires horizontal ducting and facade penetrations, into each unit. The team is considering all options at this time, including sharing ERVs between a small group of units and vertical ducting.

To address resiliency issues, the rooftop will have a large PV array. All utilities, except for hot water, will be electric. The team is looking at battery backup storage to provide electricity during power outages.

Rendering courtesy of Magnusson Architecture and Planning

(Preliminary) Passive House Metrics

Specific space heating demand	4.3 kBtu/ft ² /yr	13.6 kWh/m ² /yr
Specific space cooling demand	4.9 kBtu/ft ² /yr	15.5 kWh/m ² /yr
Source energy use intensity (EUI)	21,155 kBtu/person/yr	6,200 kWh/person/yr
Air changes per hour	0.08 CFM ₅₀ /ft ² (design)	



MIXED-USE Downtown

New York, New York

This 24-story mixed-use building embodies the challenges and risks in developing an urban site—and also the beauty of good design solutions. The adjacent building, also owned by the client, has rows of windows on its west-facing façade, providing the only source of daylight for scores of offices. The design ZH Architects developed preserves this daylight at the upper floors of the existing building by creating an intentional gap between the façades. To maintain the privacy between commercial and residential tenants, the east façade of the new building was not punctured, and the south- and north-facing façades were designed with ample glazing.

The restriction of the placement of the windows on the new building complicated the process of meeting the Passive House performance targets and made it challenging to find room for 55 well-lit apartments. “It required some creative work in plan layouts,” says Stas Zakrzewski, one of ZH’s two principal architects. Twenty percent of the units will be affordable housing, with the rest market rate. Double-height retail and lobby spaces within the thermal envelope take up the ground floor.

The foundation posed its own peculiar problems, thanks to the subsoil site conditions below, which resembled a ski slope, says Zakrzewski. In places the bedrock lies just below the cellar, which required chopping away at the schist before construction. Elsewhere the building rests on grade beams and piles. Exterior insulation will be added around the foundation’s entire perimeter, but below the foundation insulation will be installed only below its non-load-bearing sections, because a building this size can lose heat in discrete places and still hit the performance targets.

The wall assembly will include autoclaved aerated concrete (AAC), chosen for its fire resistance and its comparatively good insulative value. A water- and air-barrier membrane will be adhered to the exterior of the AAC, then 5 inches of mineral wool, and a ventilated rain screen façade.

As with other dense buildings, cooling is the dominant energy load. The south-facing windows will feature accent brows that double as shading devices to reduce summertime heat gain. Cooling, heating, and dehumidification will be supplied by a variable refrigerant flow air source heat pump with individual air-handling units in each apartment. A centralized ERV will serve all the residential units, with a second one for the retail spaces. Occupancy sensors will reduce ventilation to the retail spaces when they are empty.

Rendering courtesy of Zakrzewski + Hyde Architects

Passive House Metrics

Specific space heating demand	2.1 kBtu/ft ² /yr	6.6 kWh/m ² /yr
Specific space cooling demand	4.3 kBtu/ft ² /yr	13.6 kWh/m ² /yr
Source energy use intensity (EUI)	37.7 kBtu/ft ² /yr	119 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	

Team

Owner/Developer
[Bernstein Real Estate](#)

**Project Manager /
Owner's Representative**
[JBS Project Management](#)

**Architect & Certified
Passive House Designer**
[ZH Architects](#)

**Passive House Consulting
& Accessibility**
[Steven Winter Associates](#)

Construction Management
[KSK Construction](#)





The Senior RENAISSANCE

Bronx, New York

Some projects linger in the development phase. Such was the case for The Senior Renaissance, a nine-story, 53-unit residential building for seniors being developed by the nonprofit Mid-Bronx Senior Citizens Council; the building also includes a day care facility on the ground floor and cellar. This project was conceptualized over ten years ago but was then put on the back burner—which turned out to be a blessing. In the intervening years, Jorge Chang, a principal at Urban Architectural

Team

Developer
Mid-Bronx Senior Citizens
Council

Architect
Urban Architectural
Initiatives, RA, PC

Initiatives and lead designer for the project, took the Passive House designer training. He realized that Passive House comfort levels and energy efficiency would be an excellent fit for the building’s residents. “That’s how we came to marry Passive House and senior residential design,” says Chang.

“Meeting the Passive House objectives required rethinking some of our standard approaches to multifamily design,” says Chang, whose firm specializes in affordable and supportive multifamily residential buildings. Glazing changes will start with using triple-pane units, a potential hit to the sponsoring nonprofit and funding agency’s budget—except that the design optimizes window placement and very efficient use of natural light. Reducing the number of openings on the north-facing façade will help to shrink thermal losses. The south-facing façade will require exterior sunshades to minimize the building’s cooling demand.

The ventilation system will be quite different from a typical centralized system, with individual ERVs in each unit. The mix of studio and one-bedroom apartments will be heated and cooled using a variable refrigerant flow heat pump system with one head in each of the smaller units and two in the larger ones. The roughly 11,000-ft², nine-classroom day care serving up to 130 children will have a separate ventilation system.

The building will be constructed using a block-and-plank system, with the air barrier on the exterior side of the block. Overlaying that will be an exterior ventilation and finish system, with 7 to 8 inches of EPS insulation. The cellar level will be insulated inside and out, including underslab insulation—a new challenge for the structural engineer.

Although the Passive House approach is new for Mid-Bronx Senior Citizens Council, it found the building’s projected energy savings and lower maintenance costs to be attractive incentives. Providing a comfortable home for the elderly and an education and enrichment facility for preschool children are the nonprofit’s core missions. All involved are excited to be creating a building that will stand out in terms of its efficiency and for the populations it’s serving.



Renderings courtesy of Urban Architectural Initiatives

Passive House Metrics

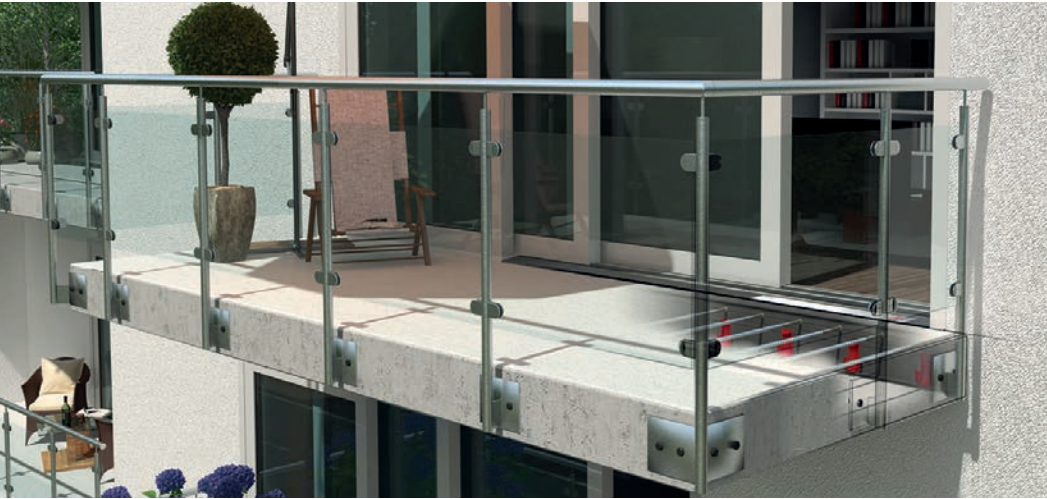
Specific space heating demand	4.0 kBtu/ft ² /yr	12.6 kWh/m ² /yr
Specific space cooling demand	3.6 kBtu/ft ² /yr	11.4 kWh/m ² /yr
Source energy use intensity (EUI)	35.8 kBtu/ft ² /yr	113 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	

Products

Air/Moisture Control
Sto

Structural Thermal Breaks
Armatherm

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As an advocate of socially and environmentally responsible design concepts, the company is committed to sustainable design, and is a member of the Health Product Declaration Collaborative. It has multiple Passive House Institute certified products including the HIT Structural Thermal Break. HIT is an ideal solution to eliminate thermal bridging as well as increase the overall energy efficiency and comfort of a building.

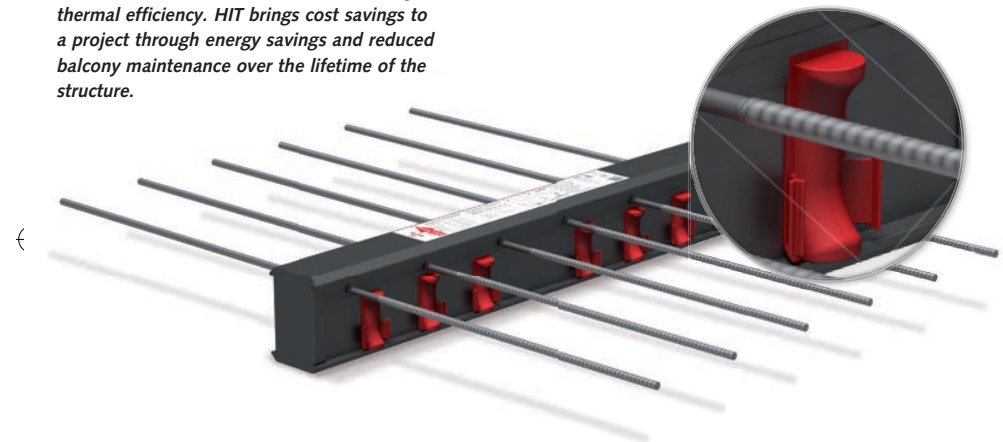
It also provides a thermal break for continuous balcony slabs and is the first ICC Approved thermal break solution for a product of this type. Insulated connections allow insulation to run continuously through the balcony, increasing the effective R-values of the wall system by almost two times compared to a continuous balcony.

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Beach Green DUNES

Queens, New York

In this era of radical weather events, it's not uncommon for a specific event to influence local design decisions. Hurricane Sandy was one such event, influencing the design of Beach Green Dunes, a 101-unit affordable housing project in Far Rockaway, a block from the Atlantic Ocean.

Mark Ginsberg, principal of New York-based architectural firm Curtis + Ginsberg Architects (C+GA), cochaired a post-Sandy housing task force. The task force determined that a multifamily resiliency manual did not exist, leading in 2015 to the development of the manual *Ready to Respond: Strategies for Multifamily Building Resilience by Enterprise Community Partners*. Ginsberg was senior advisor for this effort. Enterprise specializes in facilitating the creation of high-quality, sustainable affordable housing.

Team

Architect

[Curtis + Ginsberg Architects, LLP](#)

Builder

[Banta Home Corps](#)

Certified Passive House Consultant

[Steven Winter Associates](#)

MEP Engineers

[Johnson & Urban, LLC](#)



C+GA had long been committed to sustainability, but once it was selected for Beach Green Dunes, principals from the task force's research influenced the firm's design. Steve Bluestone, with project developer The Bluestone Organization, advocated for a Passive House project.

The seven-story building, completed in the fall of 2017, was raised 2 feet above the area's 5-foot flood level, protecting it against future catastrophic flooding. Additional resiliency measures include a bioswale garden to treat and retain storm water. A large rooftop PV and cogeneration system can provide power in the event of a utility outage, and a backup domestic water heater can work in tandem with the cogeneration unit.

The building shell is constructed of ICFs, which are noted for their high insulation levels and airtightness. The ICF concrete core includes 2.5 inches of EPS insulation on each side. The thermoplastic polyolefin roof was insulated with 7 inches of polyisocyanurate. In case of a power outage, the building will not get very cold in the winter or warm in the summer, thanks to the superior, passively resilient Passive House envelope.

Heating and cooling are provided by several variable refrigerant flow heat pumps on the roof. Each apartment has a ducted or wall-mounted VRF unit controlled by thermostat. Hot water for all units is provided by the cogeneration system on the roof. It also provides power for the building's common elements and emergency lighting. Ventilation for each unit is provided by individual ERVs. Smaller living units have ductless wall-mounted ERVs. The larger units include ducting.

With laundry facilities, an exercise room, and an exterior terrace above the flood level, coupled with the PV and Passive House detailing, Beach Green Dunes is designed for resiliency and durability. In addition, it has a fantastic ocean view and affordable prices. All new multifamily housing should be this enticing.

Products

Windows & Doors
[Rehau](#)



Photos by Peter Mauss, Esto Photography

Passive House Metrics

Specific space heating demand	0.95 kBtu/ft ² /yr	2.9 kWh/m ² /yr
Specific space cooling demand	0.89 kBtu/ft ² /yr	2.8 kWh/m ² /yr
Source energy use intensity (EUI)	33.4 kBtu/ft ² /yr	105.5 kWh/m ² /yr
Air changes per hour	0.37 ACH ₅₀	

Third Avenue APARTMENTS

Bronx, New York

Designed by Curtis + Ginsberg Architects, LLP (C+GA), Third Avenue Apartments, a mixed-use affordable housing project, is targeting LEED for Homes Platinum certification. When completed, it will be the first Certified Passive House project in the Bronx.

The project's deep, east- and west-facing zero lot line site informed the design. C+GA opted for placing the housing units into two front and rear apartment blocks, connected by a light-filled south-facing corridor overlooking a U-shaped courtyard. The courtyard provides sunlight for the interior apartments. The building layout provides an engaging environment, with consideration given to circulation patterns informed by New York City's Active Design Guidelines.

In addition to apartment units that range from studios to four bedrooms, the nine-story, mixed-use building includes an Early Education Center at the first floor and cellar. It provides ample daylight through large windows and a skylight, as well as a rear yard, and a terraced outdoor play space. Residential amenities include a reception area with public art, a gym, a laundry room, and an outdoor terrace. There is no car parking; there is a bike room on the first floor.

The inclusion of the Education Center day care and nursery school presented some atypical challenges for C+GA, particularly because mixed-use and educational Passive House standards are still in development. Education space energy consumption is significantly higher than that of residential housing. For example, the day care facility requires higher ventilation rates. While each apartment has its own ERV, the commercial and education spaces had to be handled differently. One ceiling-mounted ERV per floor with separate units for the restrooms provided a compact solution to maximize classroom space. The increase in lighting and

mechanical consumption from typical residential occupancies triggered recalculating the Passive House modeling.

The building envelope is constructed of insulating concrete forms (ICFs), with brick, multicolored metal panel, and stucco façades. In addition to high insulation value and air tightness, the ICFs are well suited to minimizing the urban ambient noise levels for the occupants. The plastic ties that hold the ICF blocks together minimize thermal bridging. The ICF manufacturer provided on-site supervision

Team

Architect

[Curtis + Ginsberg Architects, LLP](#)

Builder

Home Buildings 1

Certified Passive House Consultant

[Steven Winter Associates](#)

MEP Engineers

[Rodkin Cardinale Consulting Engineers](#)

Developer

[BronxPro Group](#)



during the construction of the first two floors. This training helped avoid problems that might have arisen from subcontractors working with an unfamiliar technology.

Mixed-use affordable urban housing can be challenging, especially when striving for Passive House performance levels. The Third Avenue Apartments demonstrate that while it's challenging, it's absolutely possible.

Photo (left) by Peter Mauss, Esto Photography; Rendering (above) by Curtis + Ginsberg Architects LLP

Products

Windows & Doors

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Air/Moisture Control

[Sto](#)

Ventilation

[Zehnder America](#)

Structural Thermal Breaks

[Armatherm](#)

Passive House Metrics

Specific space heating demand	0.94 kBtu/ft ² /yr	3 kWh/m ² /yr
Specific space cooling demand	0.94 kBtu/ft ² /yr	3 kWh/m ² /yr
Source energy use intensity (EUI)	25.7 kBtu/ft ² /yr	81.2 kWh/m ² /yr
Air changes per hour	0.38 ACH ₅₀	



425 Grand CONCOURSE

Bronx, New York

Trinity Financial was selected by the city of New York to develop a new 27-story affordable housing project in the Bronx. The city wanted a signature building representing twenty-first-century affordable housing coupled with nonresidential uses on the ground floor. Trinity's goals included Passive House certification, reduced tenant utility costs, reduced landlord operating costs, and resiliency. The resulting mixed-use building includes 277 studio to three-bedroom apartments, a medical urgent care clinic, educational and cultural facilities located within, and retail space located outside the Passive House boundaries. Tenant amenities include a fitness room, two community rooms, laundry facilities on each floor, and landscaped terraces on the 4th and 26th floors.

Team

Developer

[Trinity Mid Bronx
Development LLC](#)

Architect

[Dattner Architects D.P.C.](#)

Builder

[Monadnock Construction](#)

Certified Passive House Consultant

[Steven Winter Associates,
Incorporated](#)

Mechanical Engineers

[Dagher Engineering PLLC](#)

Due to its Passive House construction and occupant density, 425 Grand Concourse's large internal heat gains and humidity levels mean that this building is cooling-load dominated, like most other large multifamily buildings in this climate zone. The design team had to pay close attention to both the HVAC systems and the window specification and installation details to avoid condensation that could result in mold growth.

Apartment temperatures are controlled by a variable refrigerant flow heat recovery system on each floor, allowing simultaneous heating and cooling during shoulder seasons. Smart refrigerant branch controllers provide thermostatic control for each unit. As an additional benefit, building management gets separate heating and cooling consumption numbers for utility billing.

Like many sites in New York City, the building is located close to a major highway that results in high particulate content in the air, placing high demands on achieving good indoor air quality. The team settled on a total of four large ERVs, two for the higher floors, and two for the lower floors. This approach minimizes shell penetrations and maintenance issues, and reduces ducting. Each unit includes temperature, humidity, and CO₂ monitoring. Tenants can access these data to learn more about their energy usage patterns.

To address resiliency issues, there is a gas-fired generator located on the roof. A generator was originally required only to service emergency loads during a power outage. The team upsized the generator to provide power for other essential services, including one elevator; domestic water pumps (NYC water pressure only reaches the lowest four to six floors without pumping); building security; and local Wi-Fi networking. In the event of a power outage, residents can comfortably remain at home, or leave the building without having to walk down 27 flights of stairs.



Renderings courtesy of Dattner Architects

Passive House Metrics

Specific space heating demand	3.0 kBtu/ft ² /yr	9.6 kWh/m ² /yr
Specific space cooling demand	5.5 kBtu/ft ² /yr	17.4 kWh/m ² /yr
Source energy use intensity (EUI)	61.3 kBtu/ft ² /yr	193.2 kWh/m ² /yr
Air changes per hour	0.35 ACH ₅₀ (design)	

NYCHA *Holmes*

New York, New York

NYCHA Holmes is a mixed-income development on the existing Holmes Towers campus on Manhattan's Upper East Side. Informed by the NYSERDA publication *Feasibility Study to Implement the Passivhaus Standard on Tall Residential Buildings*, it is being developed under New York City Housing Authority's NextGeneration (NextGen) strategic plan, with the aim of transforming underutilized land into new housing. The 50-story tower, developed with extensive community involvement and input, will integrate into the existing neighborhood fabric through its massing, landscape, and community programming. One-half of the building's apartments will be affordable; one-half will be market rate.



Team

Design Architect
[FXCollaborative](#)

Executive Architect
[SLCE Architects](#)

Developer
[Fetner Properties](#)

MEP Engineers
[Cosentini](#)

Certified Passive House Consultant
[Vidaris](#)

NYCHA Holmes's four-story base will create a street presence in its Yorkville neighborhood and provide 13,000 square feet of recreation and community facility space that will be operated by Asphalt Green. The 340-unit residential tower will feature a mix of studio, one-, two-, and three-bedroom layouts. New playgrounds, promenade, and plaza open spaces will help integrate the tower with the other buildings on the site and strengthen the overall sense of community. The project is striving to achieve Passive House certification.

Like other Passive House high-rise projects, this project has certain design challenges. The building height, an unusual triangular plot, and several tall adjacent buildings introduce unusual local wind conditions. FXCollaborative, the design architect, paid particular attention to siting and massing to address these issues. Density and internal heat gains make the units cooling load dominated. The apartments, built to Housing and Preservation Development guidelines, don't have space for individual mechanical rooms, dictating semicentralized mechanical functions. Heating and cooling will be done by multiple variable refrigerant flow systems, one per floor, with individual heating-and-cooling units under most windows. Current plans call for five ERVs, each ventilating multiple floors, to reduce stack effect, minimize individual unit wall penetrations, and facilitate balancing.

One of the most significant challenges is the enclosure. The team is targeting a window-to-wall ratio of less than 30%. It is still investigating façade choices. Large panelized systems are most likely too expensive for this budget-constrained project. In addition, the tight building site, adjacent to a busy street, argues against the long-term use of a crane required for such systems. The team is evaluating smaller panel systems and unitized curtain walls, but both could potentially introduce more thermal bridges.

In addition to the typical Passive House benefits of thermal comfort, good air quality, reduced noise, durability, and low utility costs, the project incorporates added emphasis on other strategies. There is a rainwater catchment system to provide irrigation for the green open spaces. Healthy materials will enhance indoor environmental quality. In addition, the tower is being designed for resiliency and floodproofing.

Renderings courtesy of FXCollaborative

(Preliminary) Passive House Metrics

Specific space heating demand	2.9 kBtu/ft ² /yr	9.2 kWh/m ² /yr
Specific space cooling demand	3.4 kBtu/ft ² /yr	10.7 kWh/m ² /yr
Source energy use intensity (EUI)	36.7 kBtu/ft ² /yr	115.8 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	



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INFINITE COMFORT

511 E 86TH Street

New York, New York

On the Upper East Side of Manhattan, not far from Gracie Mansion, a new Passive House multifamily building is taking shape. Developer Carrera RS, LLC has teamed up with JBS Project Management and Steven Winter Associates, Inc. (SWA) to construct one of the tallest market rate Passive House projects in Manhattan. Twenty-two stories tall, the development will offer 105 market rate and 35 affordable rental units. The apartments will range in size from studios to two bedrooms. Most will also feature balconies and views of the East River. Community amenities will include roof terraces, a resident lounge, a fitness center, and bike storage. Although the development's amenities and features might resemble those found in nearby high-end condo buildings, its comfort and efficiency will create a standout experience.

The site is slightly unusual in that it is flag shaped, a product of being cobbled together from four existing lots. Taking full advantage of the property, the development consists of two masses, one narrower and shorter—just 12 stories—and connected by a corridor on each floor to the taller, wider mass. The building rests partially on a slab-on-grade insulated to an R-20 and partially on a full basement.

The walls will be built using aerated concrete block with an interior steel stud cavity and will be insulated on the exterior with 4 inches of EPS. All those balconies will be thermally isolated using structural thermal breaks and will be accessed by Passive House-quality full-light glass doors. As with most high-rise multifamily projects in New York, cooling is the dominant load, even though the east- and west-facing glazing is limited. Internal gains from people, lights, and appliances in a highly dense apartment building generally outweigh solar gains by 2 to 1; in this case, it's 3 to 1. Heating, cooling, and ventilation will be supplied by a centralized variable refrigerant flow heat pump system and a commercial-size ERV.

The consulting team has been working closely with a lighting designer to specify lighting solutions that will appeal to market rate clients while not exceeding the Passive House primary energy limits. The same considerations have guided the choice of in-unit appliances.

The development's owner is very committed to delivering a high-quality living experience that optimally melds comfort and sustainability.

Team

Developers

Carrera RS, LLC

Development Managers

JBS Project Management

Certified Passive House Consultant

[Steven Winter Associates, Incorporated](#)

Architect

[Arquitectonica](#)

Products

Windows & Doors

[Klearwall](#)

Air/Moisture Control

[Sto](#)

Ventilation

[Swegon](#)

Insulation

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Carrera RS, JBS, SWA, and KSK Construction Group, the general contractor, are collaborating to develop on-site inspection and testing plans that will ensure that the stringent Passive House goals for insulation and air barrier continuity are met. The anticipated completion of the project is late 2019 to early 2020.

Rendering courtesy of Arquitectonica

Passive House Metrics

Specific space heating demand	3 kBtu/ft ² /yr	9.3 kWh/m ² /yr
Specific space cooling demand	4.5 kBtu/ft ² /yr	14.2 kWh/m ² /yr
Source energy use intensity (EUI)	38.1 kBtu/ft ² /yr	120.3 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	



SENDERO Verde

New York, New York

In another Passive House first, team members who brought The House at Cornell Tech to New York, including Handel Architects and Steven Winter Associates, Incorporated (SWA), are now outdoing themselves with Sendero Verde, a very large-scale mixed-use development that will bring more than 660 affordable Passive House rental units to East Harlem. The residences will be housed in three buildings, with one being a 37-story tower. Several community spaces and a large retail space will occupy the lower floors. The site's design preserves and repositions existing community gardens and offers a public courtyard area for mingling.

The development team is a joint venture between Jonathan Rose Companies, L+M Development Partners, and Acacia Network. Handel Architects is providing all architectural services. SWA is serving as the Passive House consultant and is providing all Passive House design consulting and field verification services in

Team

Developers

Jonathan Rose Companies
L+M Development Partners
Acacia Network

Certified Passive House Consultant

[Steven Winter Associates, Incorporated](#)

Architect

[Handel Architects LLP](#)

addition to Enterprise Green Communities certification support and NYSERDA New Construction program support.

“With this large a tower, there are unique conditions in terms of thermal bridging and air sealing that need to be addressed,” says Lois Arena, SWA’s director of Passive House services. Fortunately, her—and the rest of the team’s—experience with Cornell Tech is a big advantage in addressing these conditions. “The familiarity we gained with Passive House design at Cornell Tech is helping us solve issues at Sendero much more efficiently,” says Handel Architect’s Deborah Moelis.

At Sendero, the residential tower’s wall assembly will include a brick façade and many inches of mineral wool, both exterior and within a steel-framed cavity. The construction type is cast-in-place concrete, and as there were at Cornell, there are elements that could create thermal-bridging problems. To minimize thermal transfers through the thermal envelope, penetrations will be thermally broken to the greatest extent possible and will be wrapped in mineral wool insulation for several feet out from the façade.

The entranceways, as in all buildings, are a potential problem area. A tall airtight building’s stack effect can create strong gusts near the door openings. To solve this problem, longer vestibules between two sets of doors, combined with staggering the opening and closing of these doors, will weaken the incoming wind currents.

The tower’s huge volume does have advantages, in that a given building component can have less of an impact on a building’s energy performance when its effect is averaged over the whole building. For example, Sendero Verde will have 32 balconies to house the condensing units for the variable refrigerant flow heating-and-cooling system, and each one requires an access door. This floor-by-floor strategy was also employed at Cornell Tech, where the access doors chosen were actually the type used for walk-in refrigerators. At Sendero, however, Handel has identified more cost-effective, lower-R-value doors for access to the balconies. While these doors will result in a slight performance hit, it is not a significant one in the bigger picture. And Sendero is a very big picture, one that will likely set the bar for affordable housing in New York City for years to come.



Renderings courtesy of Handel Architects

Passive House Metrics

Specific space heating demand	4.3 kBtu/ft ² /yr	13.7 kWh/m ² /yr
Specific space cooling demand	3.4 kBtu/ft ² /yr	10.8 kWh/m ² /yr
Source energy use intensity (EUI)	37.8 kBtu/ft ² /yr	119.2 kWh/m ² /yr
Air changes per hour	0.6 ACH ₅₀ (design)	



Becoming the STANDARD

by Ilana Judah, FXCollaborative

New York Passive House has much to celebrate. We have made significant strides since our inception in 2010. Our early grassroots efforts have grown to reach a critical tipping point. We now have Passive House projects in all shapes and sizes, including the tallest certified building in the world. New projects will soon surpass this impressive benchmark, characteristic of New York City's innovative and competitive spirit.

What is perhaps most indicative of our progress is our partnership with New York City. City leadership has committed to meet ambitious 80 x 50 greenhouse gas reduction targets, and recognizes that Passive House plays a crucial role in helping to achieve them. Municipal legislation and development requests for proposals (RFPs) that incorporate Passive House demonstrate this commitment.

Due to all the successful work done to advance Passive House, we are excited to build critical mass in the coming year. Our membership and trainings, offered through the North American Passive House Network (NAPHN), continue to grow in number. As market demand increases, so does the availability of Passive House-compatible building products. And while the design and construction industry still has much to learn, our local expertise is broader and deeper than ever.

The title of this book, *From Small to Extra-Large*, refers not only to the size of Passive House buildings, but also to growth and market demand. To celebrate this growth and help expand it, New York City held an Ice Box Challenge earlier this spring. Organized by Brussels-Capital Region and Brussels Invest & Export, this competition served to educate the public about the benefits of Passive House and broaden overall awareness. With this type of public outreach, Passive House will soon be not the exception, but the standard.

Photo courtesy of Ice Box Challenge NYC (May 2018, Brussels-Capital Region)

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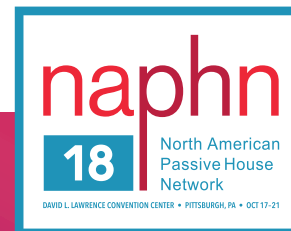
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Passive House has been recognized by the United Nations as an important way to battle

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Come learn about Passive House at the NAPHN 2018 conference in Pittsburgh on October 17-22, 2018. The NAPHN18 conference is organized by PHWPA (Passive House Western Pennsylvania). We welcome everyone to attend.

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A Roadmap for New York City's Buildings: Implement leading edge performance standards for new construction that cost-effectively achieve highly efficient buildings, looking to Passive House, carbon neutral, or "zero net energy" strategies to inform the standards. (NYC Built to Last)

