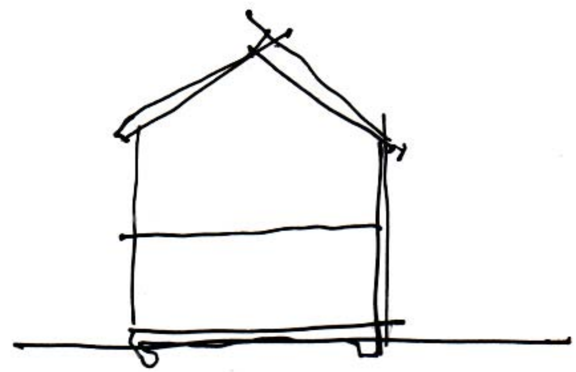
Scranton Passive House

RICHARD PEDRANTI ARCHITECT

RPA



Richard Pedranti Architect is a full-service architecture firm serving the Upper Delaware River Region, as well as Philadelphia and New York. Since 1998, we have been creating environments that combine our client’s unique values with the extraordinary natural landscape of our region. Located in the historic village of Milford, Pennsylvania, RPA specializes in Passive House and high performance buildings putting modern building science to work creating beautiful, healthy, comfortable, and energy efficient buildings.

TABLE OF CONTENTS

RPA

SCRANTON PASSIVE HOUSE

Location	Scranton, PA
Area	2,100 sqft
Year	2015
HERS	28

DESCRIPTION

The Scranton Passive House is the 112th PHIUS Certified Passive House in North America. The residence is home for two University of Scranton professors and their teenage children. Located on a gently sloping city lot in the hill section of Scranton with east and south views, the site has excellent access to free energy from the sun.

DESIGN

The first floor has an open kitchen, dining, and living space along with a mudroom, office, powder room, laundry room, and mechanical room. The second floor has 3 bedrooms, 2 baths, and a den. A generous front porch on the north side of the home is connected to a large screened porch on the northwest corner. An arbor across the south side provides summer shading and an outdoor porch overlooking the neighborhood. A garden shed to the northwest of the screened porch will accommodate solar panels to produce enough on-site energy to achieve net zero energy status in the future. The new home meets the rigorous Passive House standard ensuring the most comfortable and healthy indoor environment available.

"Once we decided to build a house, the only sensible thing to do in the 21st century is to build a house that uses the least energy possible."

Declan Mulhall, homeowner

RPA

PASSIVE HOUSE OVERVIEW

WHAT IS PASSIVE HOUSE?

"Passive House" is today's most energy efficient building standard. Buildings that meet the Passive House standard use 80% less energy for heating and cooling than conventional buildings yet are markedly more comfortable and healthy than traditional buildings. A Passive House conserves energy by creating a virtually air-tight, super insulated, compact building enclosure that uses the sun and heat emanating from people and equipment to achieve a comfortable indoor environment. A ventilation system including what is called a heat recovery ventilator or HRV s used to provide a continuous supply of filtered fresh air. Added all together, Passive House offers a triple bottom line: (1) personal health and comfort, (2) energy efficiency, and (3) afford-ability.

① SOLAR ORIENTATION

Passive House design employs detailed annual weather data to model a building's energy performance. The building form emerges from minimizing losses through the exterior enclosure resulting in efficient geometry. The windows sizes and orientation are optimized for energy balance during the entire year. Additionally, the well balanced passive solar design adds excellent daylighting throughout the interior.

② HIGH INSULATION

Passive House buildings are super insulated. With walls two to three times as thick as today's standard construction, the inside temperature is stable and predictable without the need for heating or cooling adjustments. Wall assemblies are analyzed and detailed to allow for proper moisture management that results in a long lasting and exceptionally healthy building.

③ HIGH PERFORMANCE WINDOWS AND DOORS

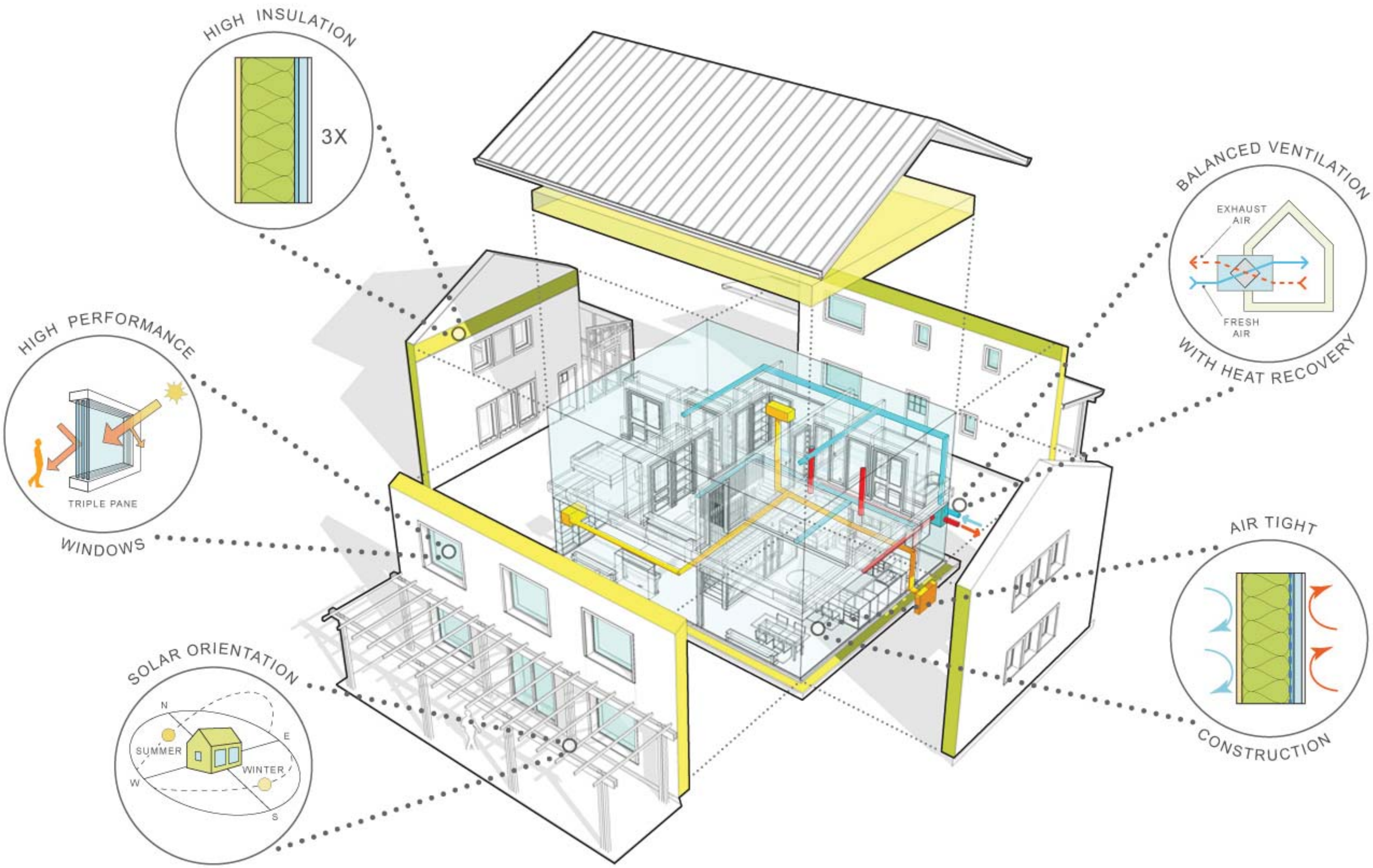
Historically, windows and doors are weak links in a building's thermal defense system. We can all relate to the drafts they can create in an average home. Passive House design places significant emphasis on specifying high performance windows and exterior doors. To meet the high performance needs of various climate zones, windows must meet strict standards regarding: insulation, air tightness, and solar heat gain values. Well detailed window design and flawlessly executed window installation are critical to the performance of Passive House buildings.

④ AIR TIGHT ENCLOSURE

Passive House takes great care in designing, constructing and testing the building enclosure for industry leading leakage control. Blower door testing is a mandatory technique in assuring high building performance through a virtually leak free enclosure. Walls are carefully designed to be virtually air tight, while allowing watehole in the exterior wall the size of a garbage can lid A Passive House has total air leakage about the size of a baseball or smaller.

⑤ BALANCED VENTILATION WITH HEAT RECOVERY

The "lungs" of a Passive House is a box called a "heat recovery ventilator" (HRV). It provides a constant supply of filtered fresh air and saves money by recycling the energy that already exists in the home's indoor air. In the HRV, the heat from outgoing stale air is transferred to the incoming fresh air, while it is being filtered. It provides continuous comfort and a huge upgrade in indoor air quality that is particularly important for people sensitive to material off-gassing, allergies and other air-borne irritants.

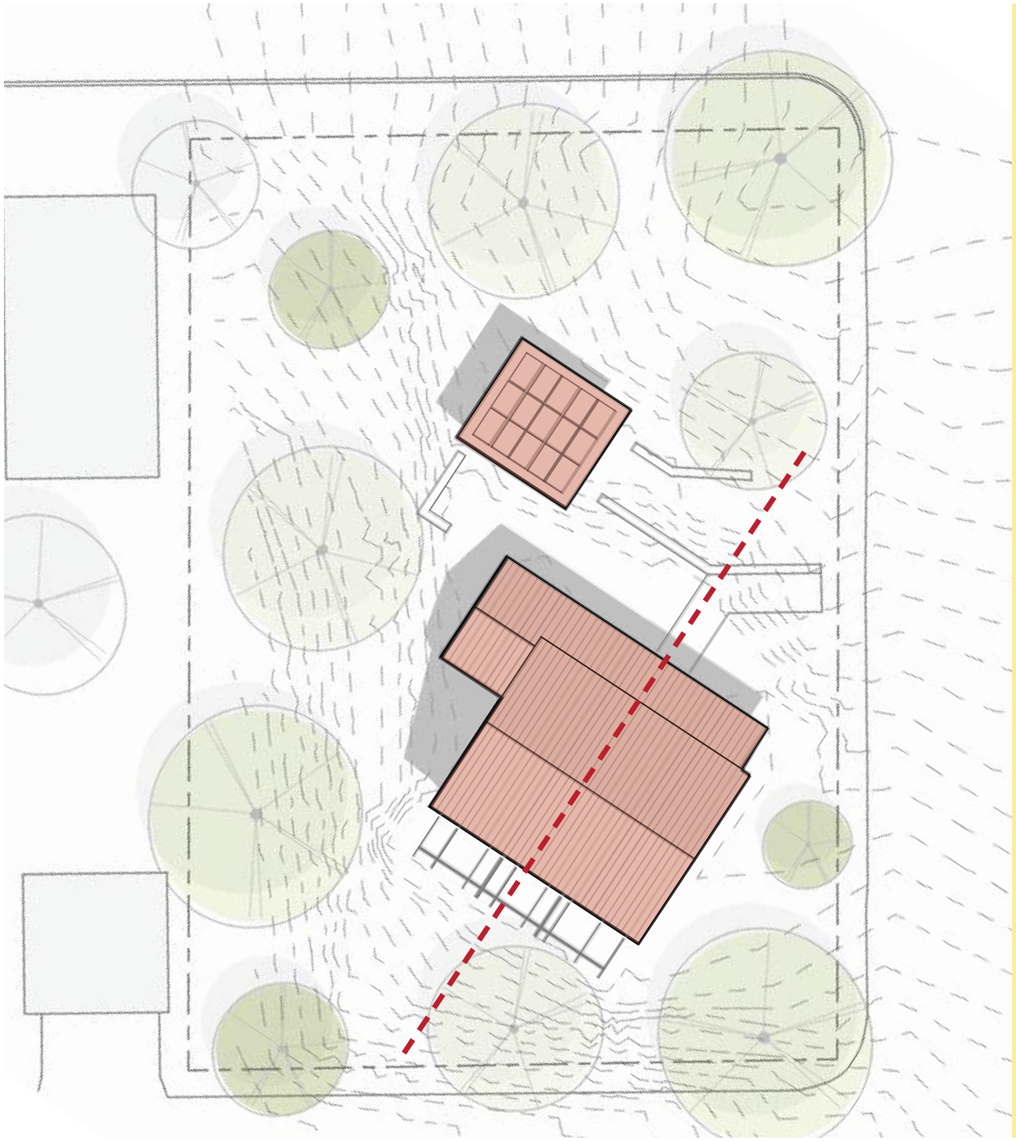

HIGH INSULATION
3X
HIGH PERFORMANCE
TRIPLE PANE
WINDOWS
SOLAR ORIENTATION
N
SUMMER
E
WINTER
W
S
BALANCED VENTILATION
EXHAUST AIR
FRESH AIR
WITH HEAT RECOVERY
AIR TIGHT
CONSTRUCTION

RPA

RPA

RPA

FIGURE GROUND DRAWING



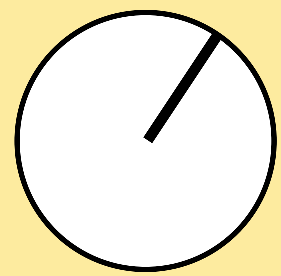
Scranton Passive House Site Planning

Based on a detailed analysis of solar exposure and neighboring structures, the Scranton Passive House is orientated so the south wall is within 5 degrees of solar south. This assures maximum access to free energy from the sun. Rotating the house from the traditional neighborhood grid also allows for views over the southern neighborhood towards Nay Aug Park, a garden oasis in the heart of Scranton.

About Passive House solar orientation

Passive House design employs detailed annual weather data to model a building's energy performance. The building form emerges from minimizing losses through the exterior enclosure resulting in efficient geometry. The windows sizes and orientation are optimized for energy balance during the entire year. Additionally, the well balanced passive solar design adds excellent daylighting throughout the interior.

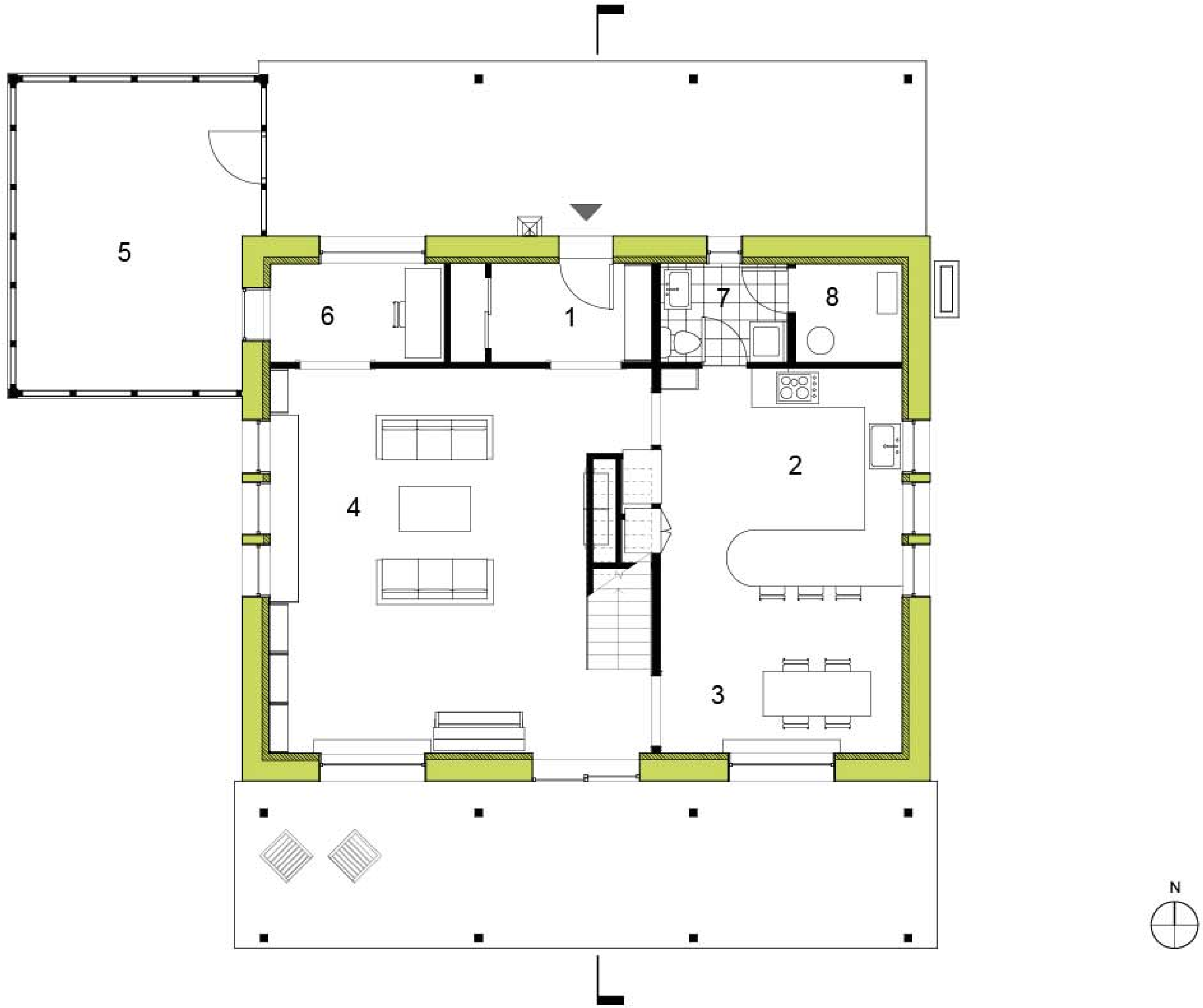
NORTH



SITE PLAN

FIRST FLOOR PLAN

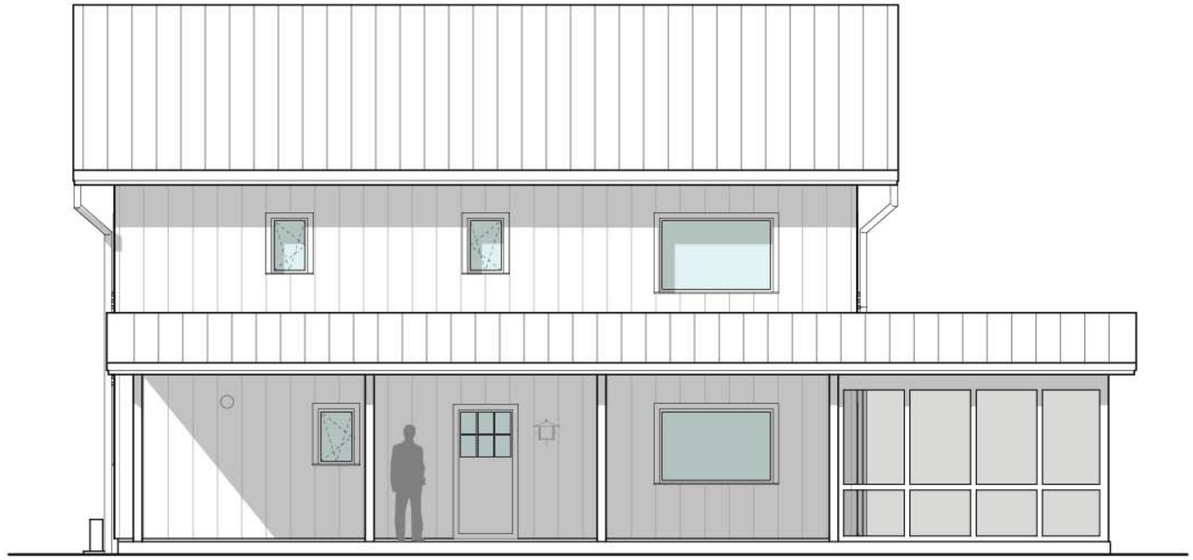
1 ENTRY
2 KITCHEN
3 DINING ROOM
4 LIVING ROOM
5 SCREEN PORCH
6 OFFICE
7 POWDER ROOM
8 MECHANICAL



SECOND FLOOR PLAN

9 BEDROOM 1
10 BATHROOM 2
11 BATHROOM 3
12 BEDROOM 2
13 BEDROOM 3
14 HALL CLOSET
15 DEN

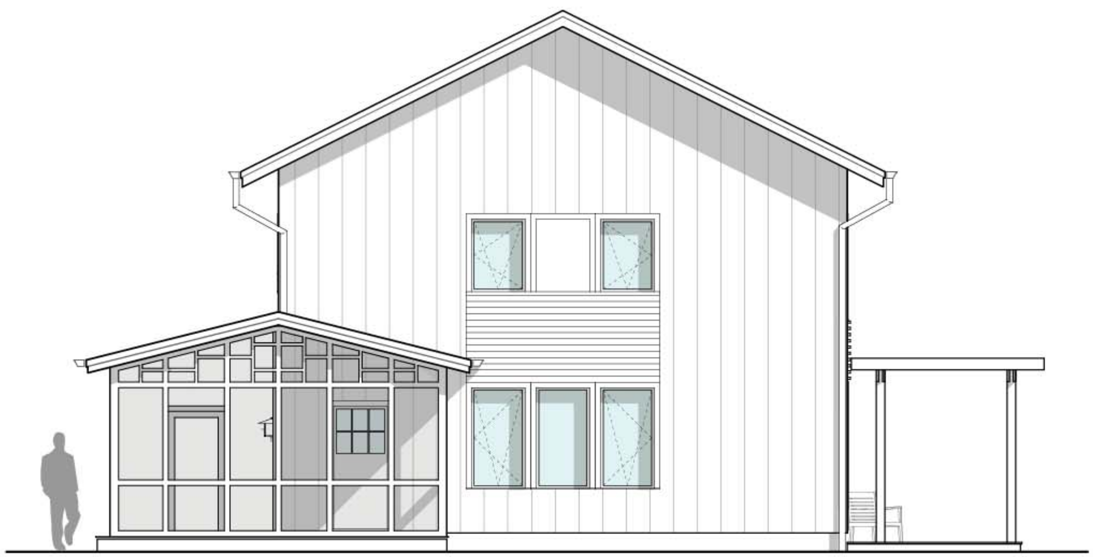
RPA



NORTH ELEVATION

SOUTH ELEVATION

EAST ELEVATION

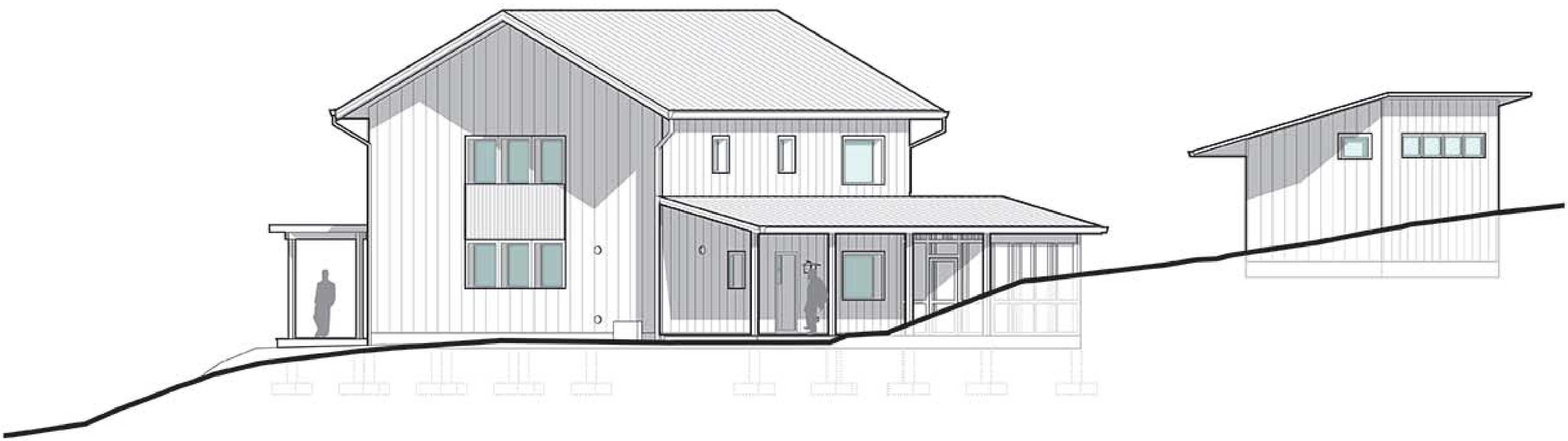


WEST ELEVATION

OBLIQUE NORTH ELEVATION

OBLIQUE NORTH ELEVATION

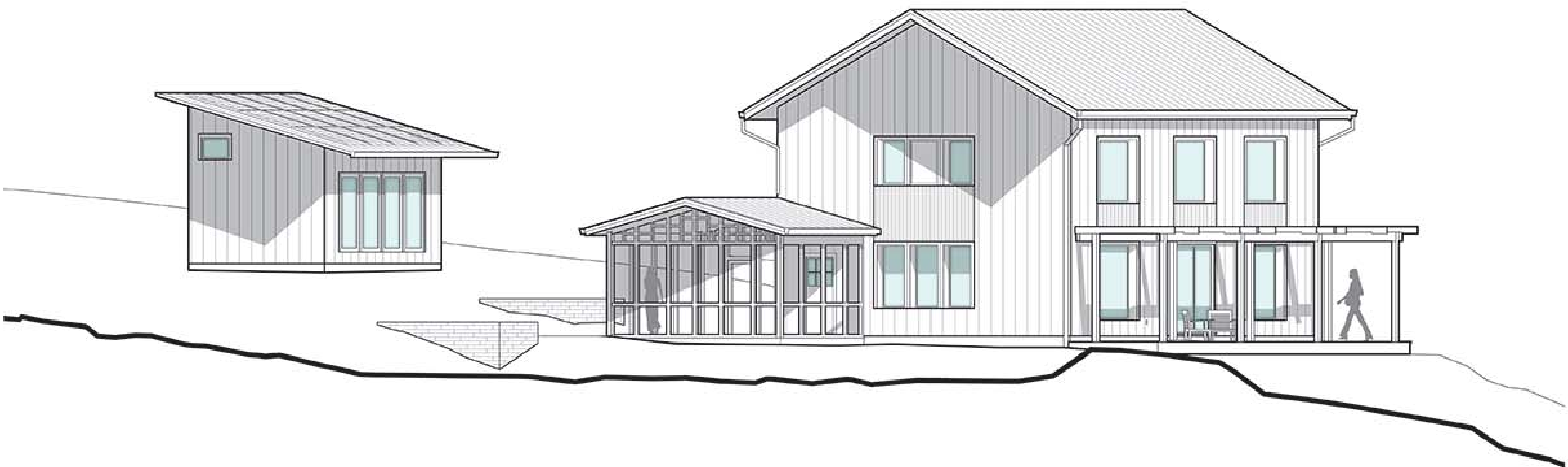
OBLIQUE EAST ELEVATION



OBLIQUE EAST ELEVATION

OBLIQUE SOUTH ELEVATION

OBLIQUE WEST ELEVATION



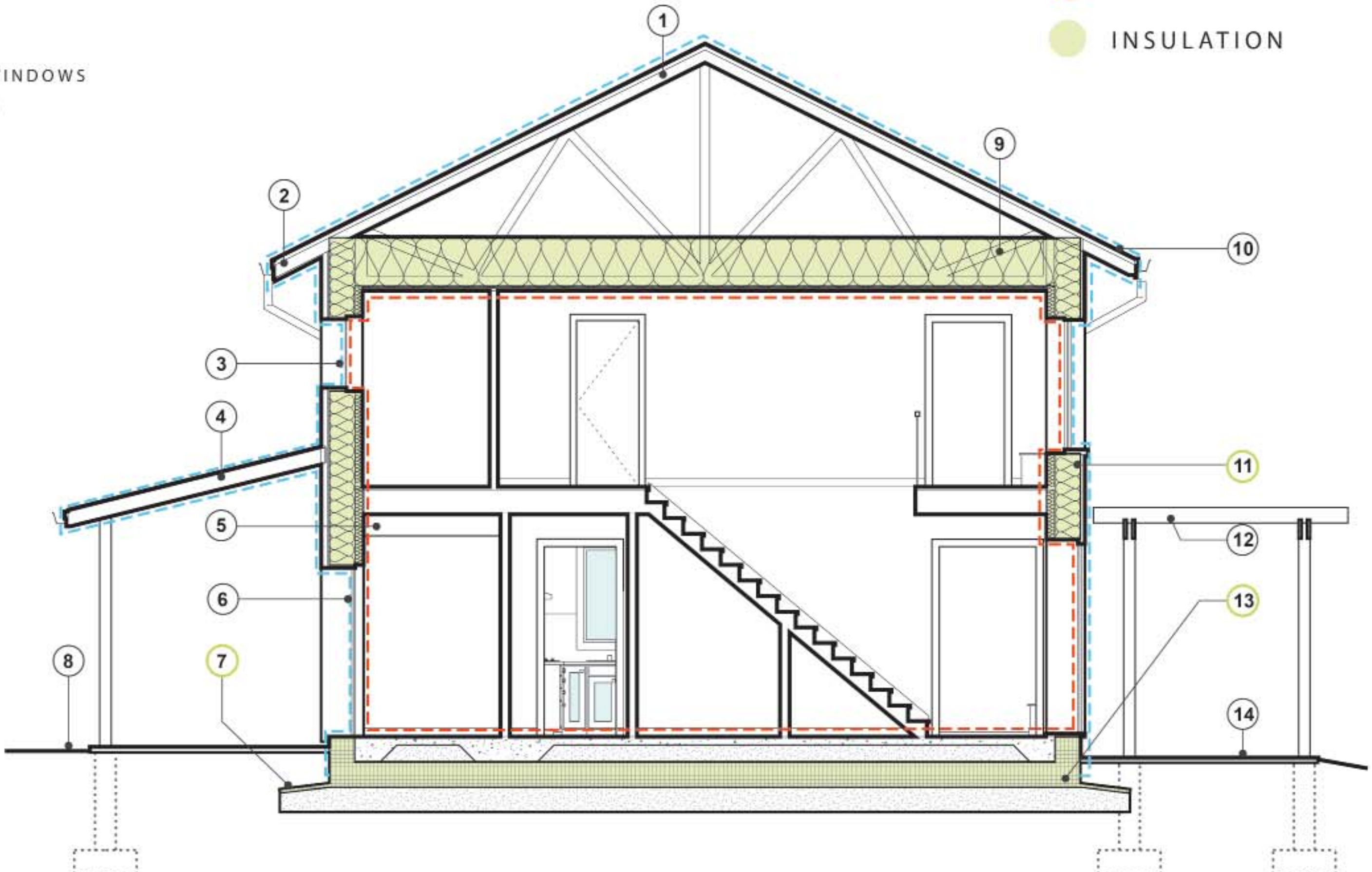
SECTION

RICHARD PEDRANTI ARCHITECT WWW.RICHARDPEDRANTI.COM 129 SAWKILL AVENUE, MILFORD, PA 18337 (570) 296 - 0466

BUILDING SECTION

1 30" RAISED HEEL ENERGY TRUSS
2 2' ROOF OVERHANG
3 TRIPLE PANE INTUS CASEMENT WINDOWS
4 EXPOSED PORCH ROOF FRAMING
5 MECHANICAL CHASE
6 ENTRANCE DOOR
7 EPS FRONT WING
8 GRADE
9 6:12 PITCH ROOF ASSEMBLY
10 SOLAR SHADING
11 TJI WALL ASSEMBLY
12 SOLAR SHADING
13 CONCRETE SLAB ASSEMBLY
14 PATIO

WATER CONTROL LAYER
THERMAL CONTROL LAYER
AIR & VAPOR CONTROL LAYER
INSULATION

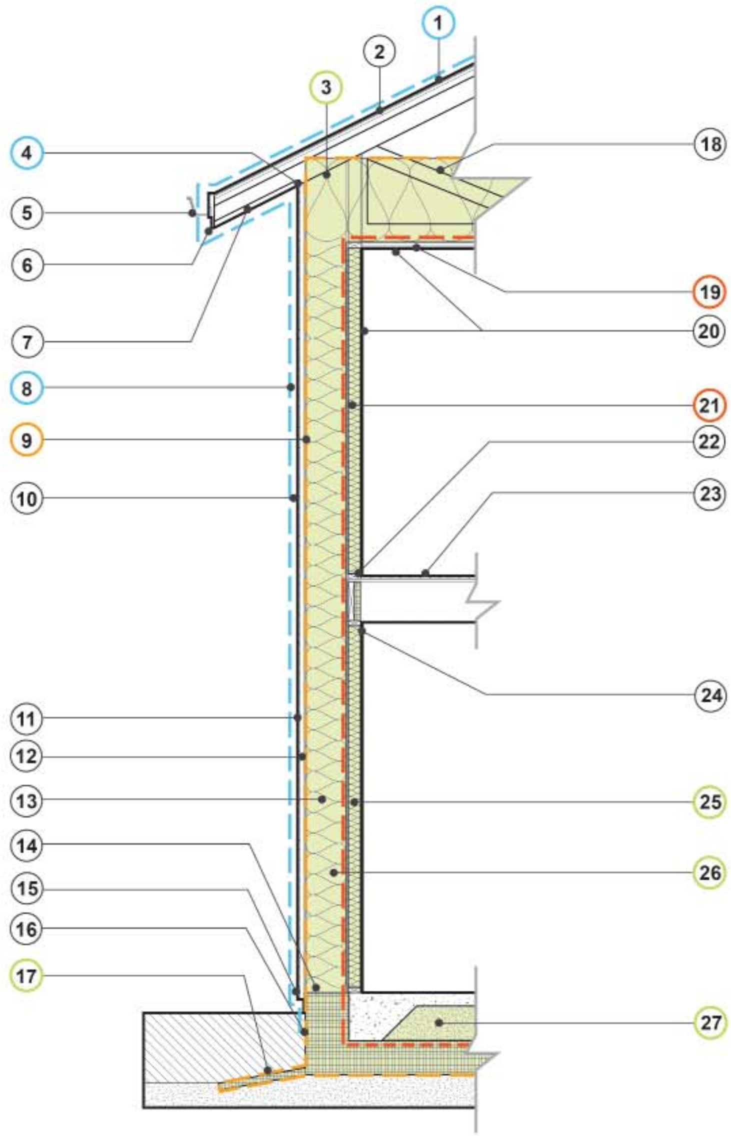


RPA

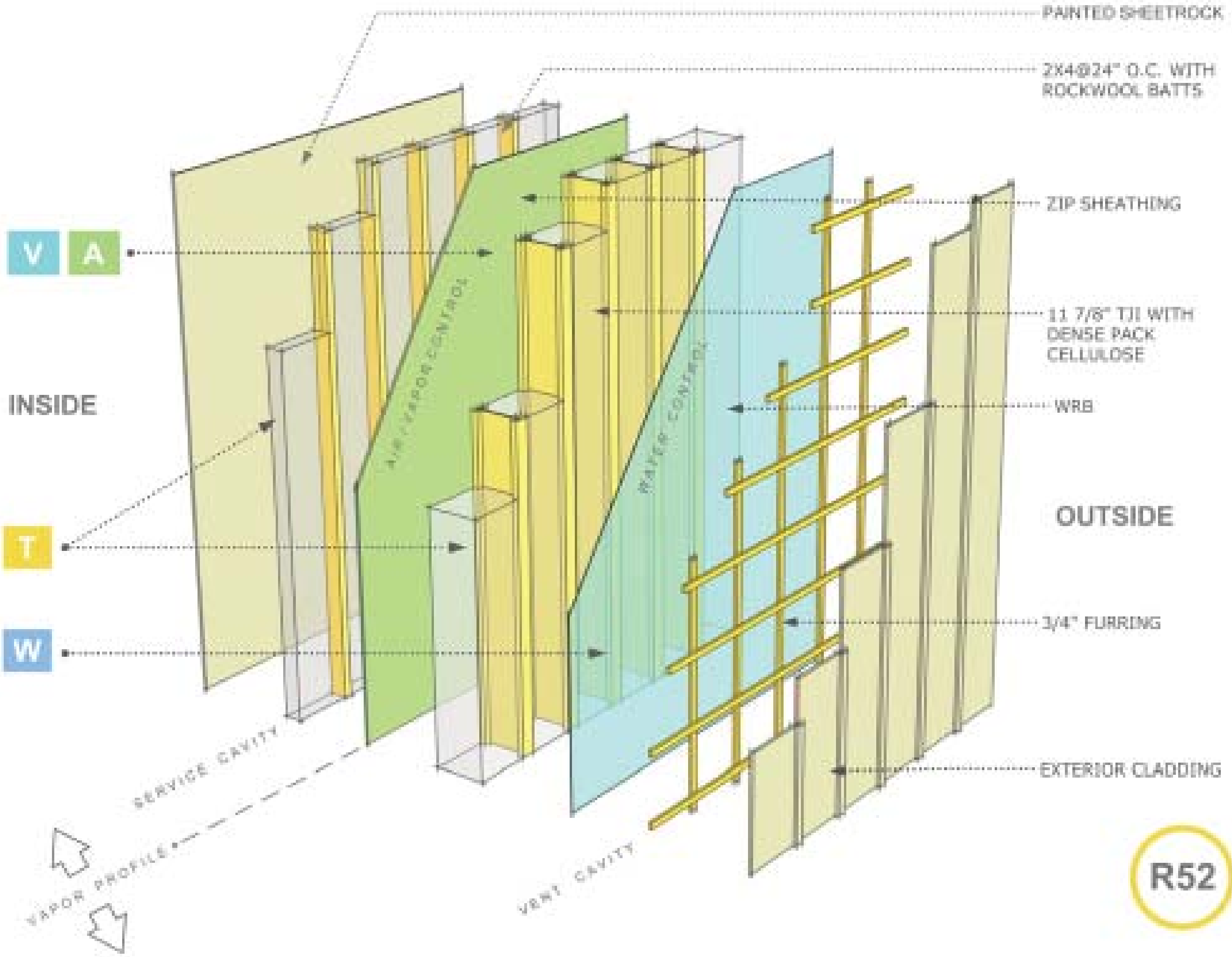
RPA SCRANTON PASSIVE HOUSE

WALL SECTION A

1 METAL ROOF
2 ROOF SHEATHING
3 INSULATION BAFFLE
4 SCREENED AND VENTED WALL CAVITY
5 CONTINUOUS ALUMINUM GUTTER
6 PAINTED TRIM
7 VENTED SOFFIT
8 SIGA MAJVEST WRB
9 THERMAL CONTROL LAYER
10 WOOD CLADDING
11 3/4" WOOD FURRING
12 1/2" FIBERBOARD SHEATHING
13 11 7/8" TJI
14 1 1/4" PSL
15 SCREENED VENT
16 FIBER-CEMENT WITH PARGING
17 EPS FROST WING & 12" EPS INSULATION
18 30" RAISED HEEL ENERGY TRUSS
19 OSB | SEAMS TAPED WITH SIGA WIGLUV
20 3/4" GYPUMBOARD
21 AIR & VAPOR CONTROL LAYER | OSB TAPED
22 2X4" PLATE
23 3/4" SUBFLOOR & FINISHED FLOORING
24 2x4" TOP PLATE
25 ROCKWOOL INSULATION
26 11 7/8" DENSE PACK CELLULOSE INSULATION
27 PERLITE



WATER CONTROL LAYER
THERMAL CONTROL LAYER
AIR & VAPOR CONTROL LAYER
INSULATION



RPA

WALL PH-1

Super-insulated Passive House wall

CLIMATE ZONES 5 AND 6

A proven Passive House wall assembly
Has a high R-value
Uses conventional building technology
Has an excellent vapor profile
All 4 control layers are continuous
Cellulose is hygroscopic
Cellulose is inexpensive
Cellulose has low embodied energy
The primary air seal is rigid and protected
Has a service cavity
Is thermal bridge free
Vent space at cladding allows for drying

CONTROL LAYERS

T	THERMAL	CELLULOSE / ROCKWOOL
W	WATER	SOLITEX MENTO
A	AIR	HUBER ZIP SHEATHING
V	VAPOR	HUBER ZIP SHEATHING

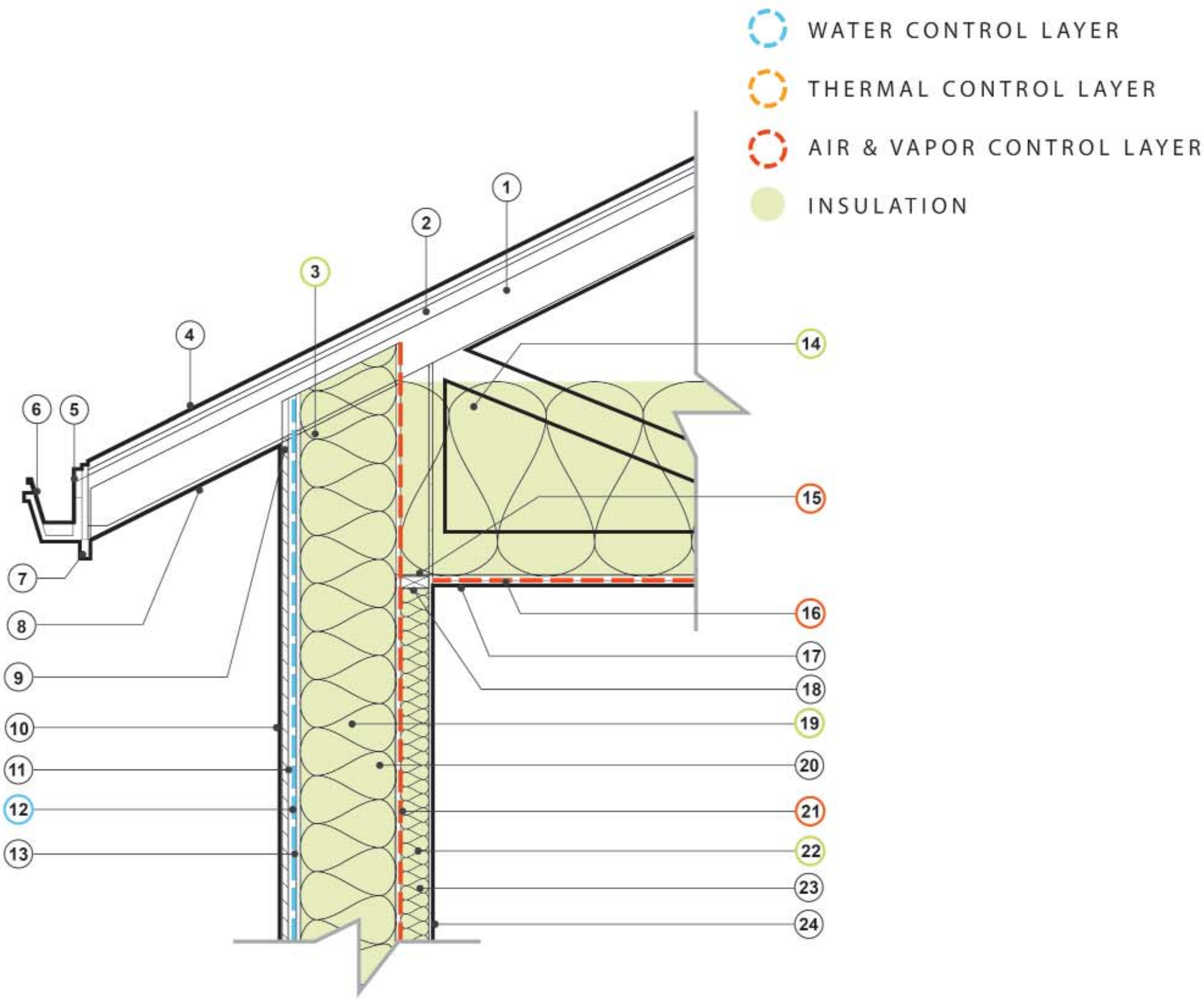
RICHARD PEDRANTI ARCHITECT

RPA

RPA SCRANTON PASSIVE HOUSE

WALL-ROOF DETAIL

1 30" RAISED HEEL TRUSS
2 5/8" ROOF SHEATHING
3 INSULATION BAFFLE
4 METAL ROOF
5 ALUMINUM DRIP EDGE
6 CONTINUOUS ALUMINUM GUTTER
7 PAINTED TRIM
8 VENTED SOFFIT
9 SCREEN CLADDING VENT
10 PAINTED WOOD CLADDING
11 3/4" FURRING AND CLADDING VENT SPACE
12 SIGA MAJVEST WRB
13 FIBERBOARD SHEATHING
14 24" LOOSE FILL CELLULOSE INSULATION
15 12" OSB STRIP ON TOP PLATE
16 OSB | SEAMS TAPED WITH SIGA WIGLUV
17 5/8" GYPSUMBOARD
18 2x4" TOP PLATE
19 11 7/8" DENSE PACK CELLULOSE INSULATION
20 11 7/8" TJI
21 OSB | SEAMS TAPED WITH SIGA WIGLUV
22 3 1/2" MINERAL WOOL
23 2X4" STRUCTURAL WALL @ 24" O.C.
24 5/8" GYPSUMBOARD

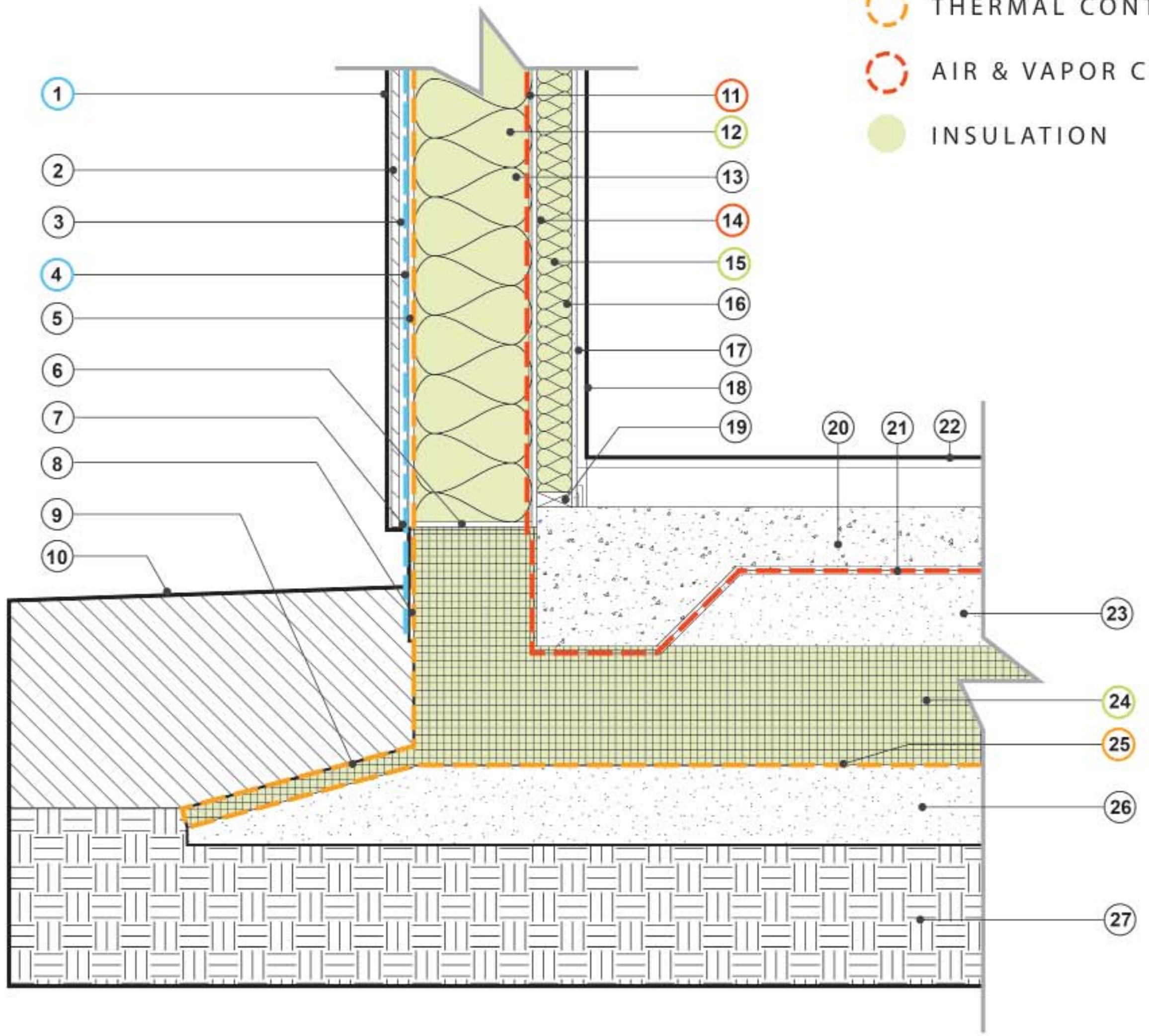


RPA

SCRANTON
PASSIVE HOUSE

WALL-SLAB DETAIL

1 WATER CONTROL LAYER
2 PAINTED WOOD CLADDING
3 3/4" FURRING AND AIR SPACE
4 SIGA MAJVEST WRB
5 FIBERBOARD SHEATHING
6 1 1/4" PSL
7 SCREENED CLADDING VENT
8 PARGED FIBER-CEMENT
9 2" EPS FROST WING
10 GRADE
11 AIR & VAPOR CONTROL LAYER
12 11 7/8" DENSE PACK CELLULOSE INSULATION
13 11 7/8" TJI
14 OSB | SEAMS TAPED WITH SIGA WIGLUV
15 3 1/2" MINERAL WOOL INSULATION
16 STRUCTURAL 2X4" STUD WALL
17 5/8" GYPSUMBOARD
18 INTERIOR FINISH
19 2X4" PLATE
20 6" POURED CONCRETE SLAB
21 10 MLL POLY
22 FLOORING
23 8" PERLITE
24 12" EPS INSULATION
25 THERMAL CONTROL LAYER
26 8" COMPACTED #2B STONE
27 UNDISTURBED SOIL



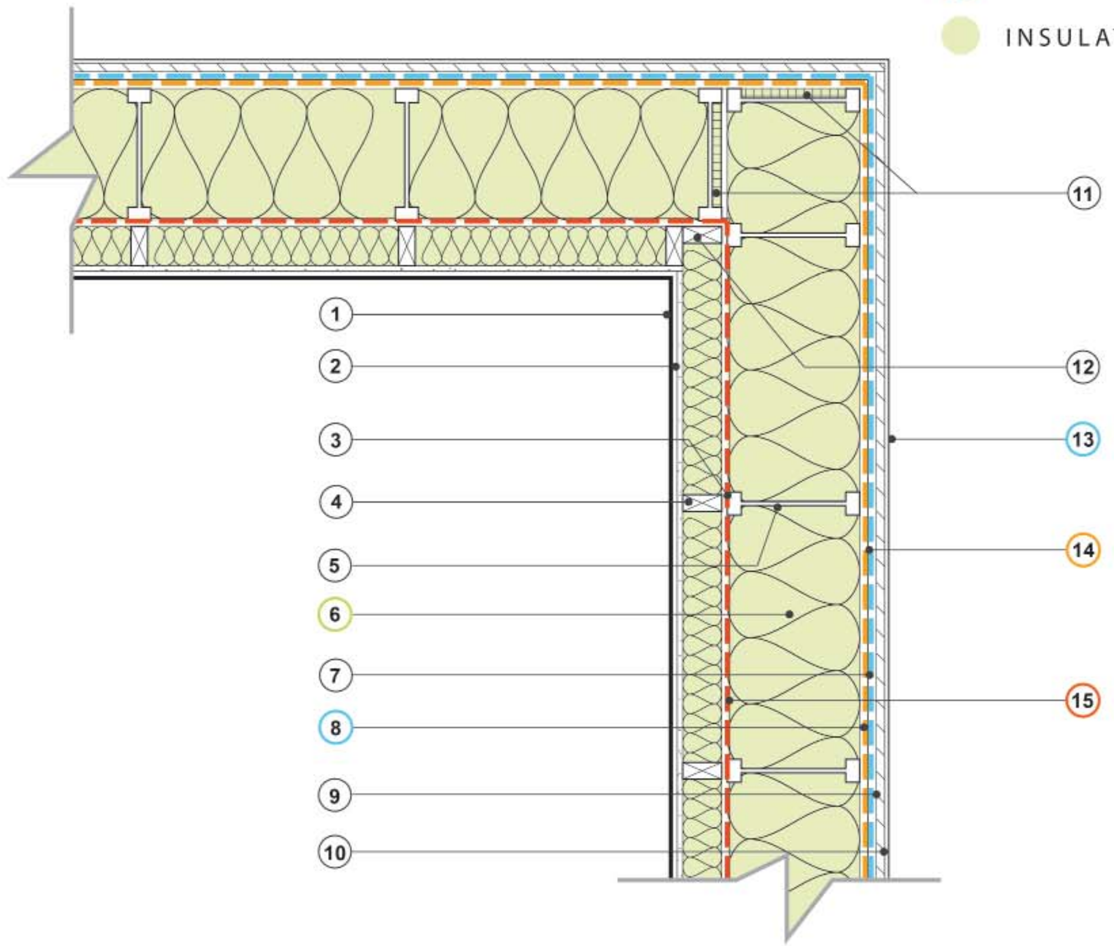
WATER CONTROL LAYER
THERMAL CONTROL LAYER
AIR & VAPOR CONTROL LAYER
INSULATION

RPA

RPA SCRANTON PASSIVE HOUSE

WALL PLAN DETAIL

1 1/2" GYPSUMBOARD
2 2X4" STRUCTURAL WALL @ 24" O.C.
3 ROCKWOOL | CAVITY INSULATION
4 OSB | SEAMS TAPED WITH SIGA WIGLUV
5 11 7/8" TJI
6 11 7/8" DENSE PACK CELLULOSE
7 FIBERBOARD
8 SIGA MAJVEST WRB
9 3/4" FURRING STRIPS
10 VENTED WOOD SIDING
11 EPS INSULATION
12 (2)2X4" AT CORNER
13 WATER CONTROL LAYER
14 THERMAL CONTROL LAYER
15 AIR & VAPOR CONTROL LAYER



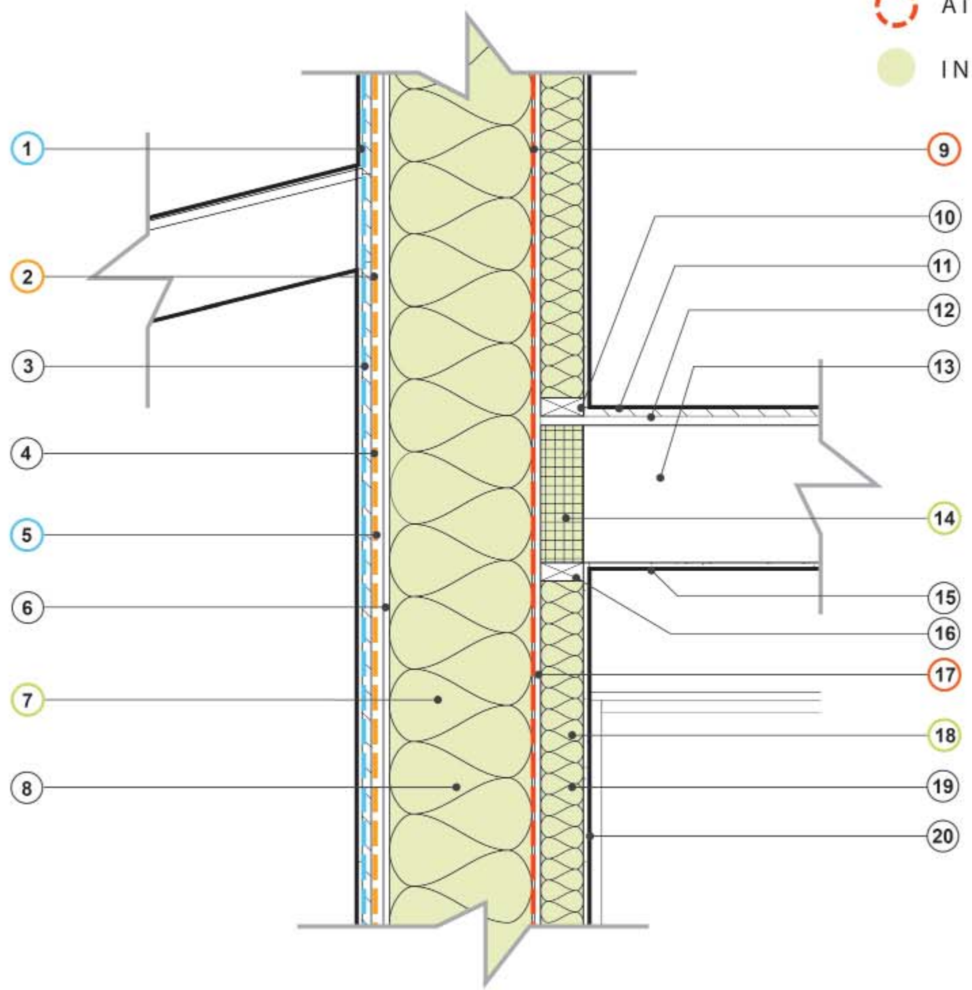
WATER CONTROL LAYER
THERMAL CONTROL LAYER
AIR & VAPOR CONTROL LAYER
INSULATION

RICHARD PEDRANTI ARCHITECT WWW.RICHARDPEDRANTI.COM 129 SAWKILL AVENUE, MILFORD, PA 18337 (570) 296 - 0466

RPA SCRANTON PASSIVE HOUSE

WALL-FLOOR DETAIL

1 WATER CONTROL LAYER
2 THERMAL CONTROL LAYER
3 PAINTED WOOD CLADDING
4 3/4" FURRING AND VENT SPACE
5 SIGA MAJVEST WRB
6 FIBERBOARD SHEAHTING
7 11 7/8" DENSE PACK CELLULOSE INSULATION
8 11 7/8" TJI VERTICAL
9 AIR & VAPOR CONTROL LAYER
10 2X4" PLATE
11 3/4" T&G WOOD FLOORING
12 3/4" FLOOR SHEATHING
13 11 7/8" TJI JOISTS
14 EPS INSULATION
15 5/8" GYPSUMBOARD
16 2X4" TOP PLATE
17 OSB | SEAMS TAPED WITH SIGA WIGLUV
18 3 1/2" MINERAL WOOL BATT INSUALTION
19 2X4" STRUCTURAL WALL @ 24" O.C.
20 5/8" GYPSUMBOARD



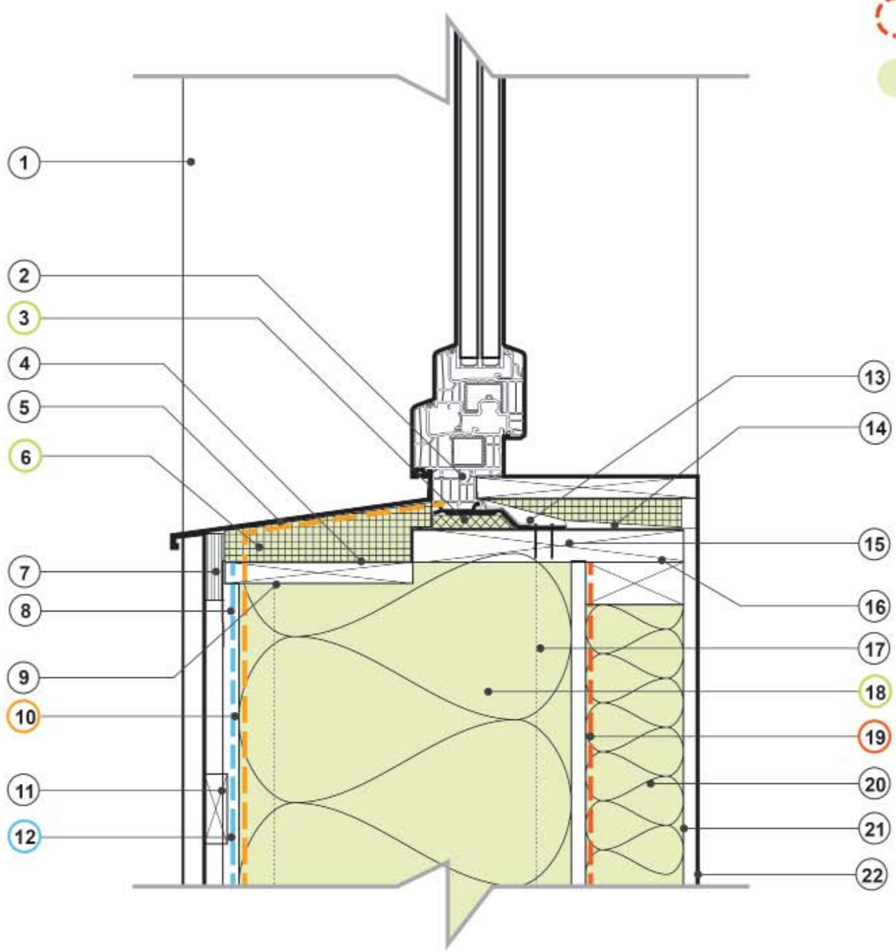
WATER CONTROL LAYER
THERMAL CONTROL LAYER
AIR & VAPOR CONTROL LAYER
INSULATION

RPA

RPA SCRANTON PASSIVE HOUSE

WINDOW SILL DETAIL

1. WINDOW JAMB BEYOND
2. UNDER SILL PROFILE BY INTUS
3. SPRAY FOAM OR FOAM TAPE
4. 3M 8067 TAPE
5. METAL WINDOW SILL
6. EPS INSULATION
7. COR O VENT
8. SIGA WIGLUV | SIGA MAJVEST WRB
9. 3/4" WINDOW JAMB EXTENSION
10. THERMAL CONTROL LAYER
11. 3/4" FURRING AND AIR SPACE
12. SIGA MAJVEST WRB
13. WINDOW INSTALLATION CLIP
14. VYCOR
15. 1 1/4" #12 WOOD SCREWS
16. 1 1/4" TIMBERSTRAND
17. 11 7/8" TJI VERTICAL
18. DENSE PACK CELLULOSE
19. OSB | SEAMS TAPED WITH SIGA WIGLUV
20. MINERAL WOOL INSULATION IN SERVICE CAVITY
21. 3 1/2" STRUCTURAL STUD WALL @ 24" O.C.
22. PAINTED GYPSUM BOARD (INTERIOR FINISH)



WATER CONTROL LAYER

THERMAL CONTROL LAYER

AIR & VAPOR CONTROL LAYER

INSULATION

RICHARD PEDRANTI ARCHITECT WWW.RICHARDPEDRANTI.COM 129 SAWKILL AVENUE, MILFORD, PA 18337 (570) 296 - 0466

RPA SCRANTON PASSIVE HOUSE

WINDOW HEAD DETAIL

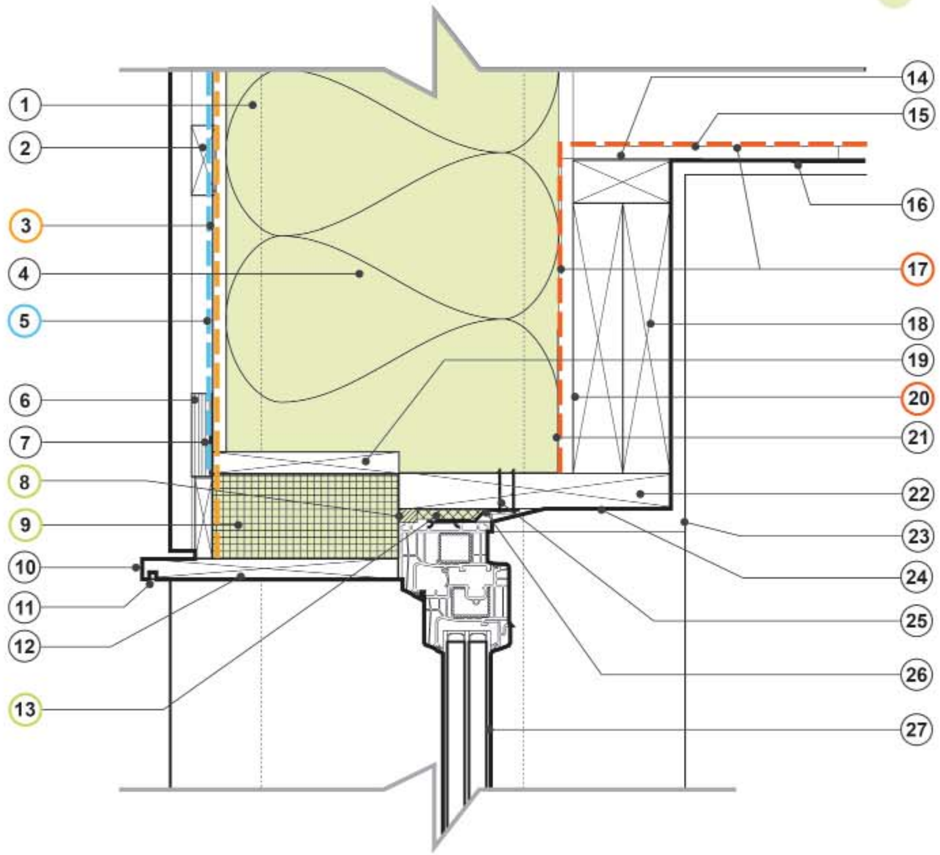
WATER CONTROL LAYER

THERMAL CONTROL LAYER

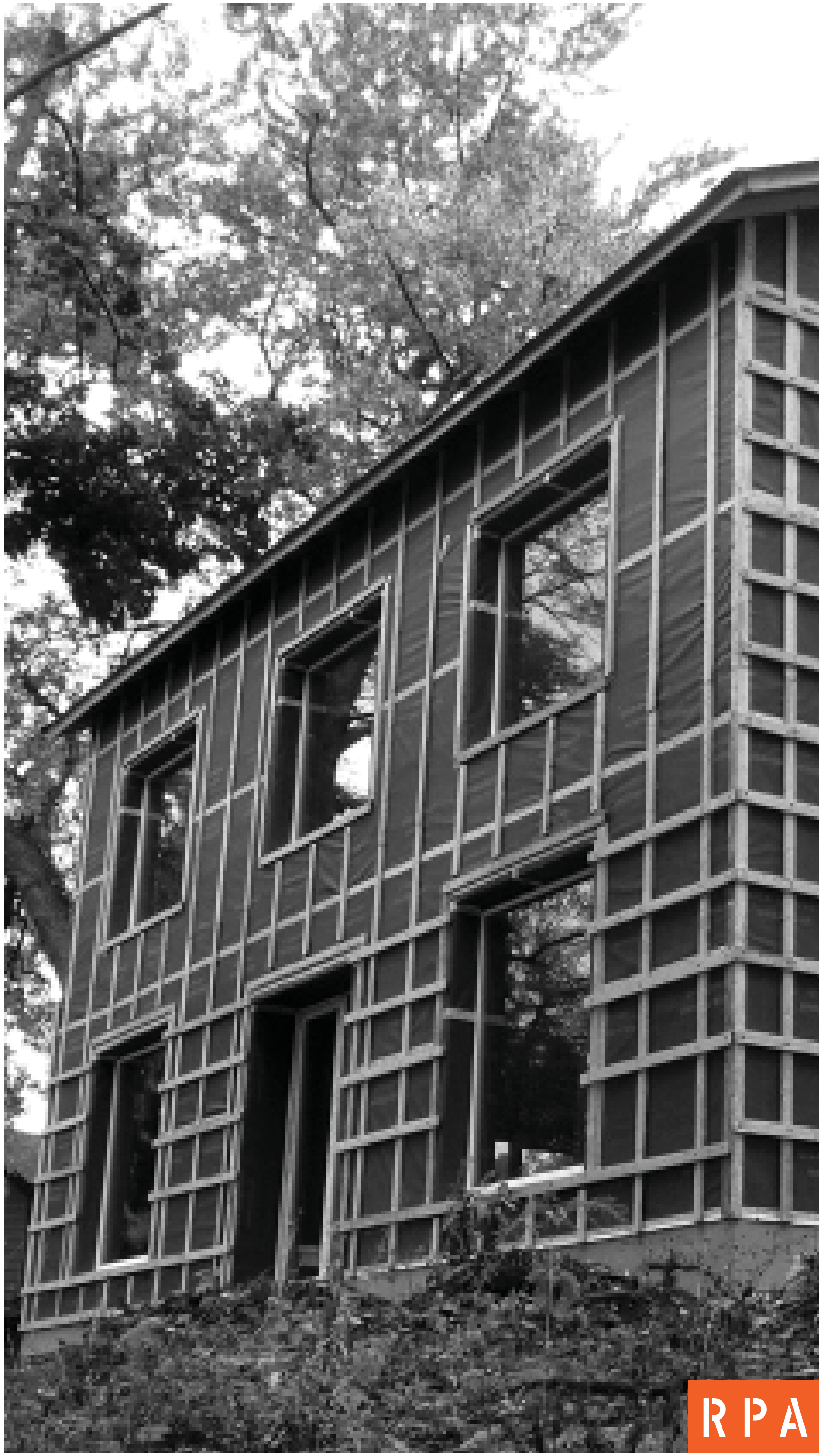
AIR & VAPOR CONTROL LAYER

INSULATION

1 11 7/8" TJI VERTICAL
2 3/4 " FURRING AND AIR SPACE
3 THERMAL CONTROL LAYER
4 DENSE PACK CELLULOSE INSULATION
5 SIGA MAJVEST WRB
6 COR O VENT
7 3M 8067 TAPE
8 SPRAY FOAM OR FOAM TAPE
9 EPS INSULATION
10 METAL DRIP CAP
11 CAPILLARY BREAK
12 EXTENSION JAMB
13 SPRAY FOAM OR FOAM TAPE
14 VYCOR
15 12" OSB STRIP
16 TAPED SEAM AT OSB
17 AIR CONTROL LAYER
18 HEADER
19 3/4" WINDOW JAMB EXTENSION
20 OSB
21 VYCOR
22 1 1/4" TIMBERSTRAND
23 PAINTED GYPSUM BOARD
24 VYCOR
25 1 1/4" #12 WOOD SCREWS
26 WINDOW CLIP
27 TRIPLE PANE INTUS EFORTE INSWING CASEMENT WINDOW



RPA



RPA

SCRANTON PASSIVE HOUSE DATA

PROJECT INFORMATION

Location	Scranton, PA
Size	2,153 sqft
Climate Zone	5/6 Cold
HERS	28
Construction	Complete 2015
Cost	$165/sqft
Modeling Tool	PHPP/REMRATE
Monitoring	RPA PHIOT

PASSIVE HOUSE ENERGY CRITERIA

Annual Heat Demand	4.52 KBTU/(FT2YR)
Heat Load	2.75 BTU/(FT2HR)
Primary Energy	31.5 KBTU/(FT2YR)
Air Tightness	0.47 ACH @ 50 Pa
Treated Floor Area	1,750 sqft

CONSTRUCTION SPECIFICATIONS

Floor	R=76	Slab on Grade
Walls	R=61	2x4 Wall + TJI
Roof	R=85	Raised Heel Energy Truss
Windows	R=7	Intus Eforte

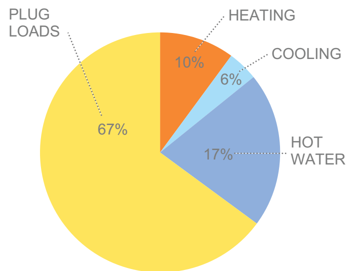
MECHANICAL SYSTEMS

Ventilation	Renewaire ERV
Heating & Cooling	Mitsubushi ASHP
Domestic Hot Water	GE HWHP

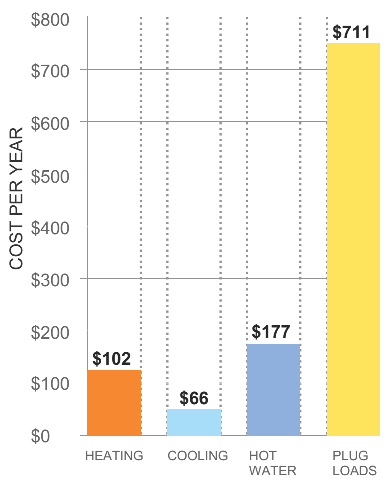
RPA PASSIVE HOUSE MORPHOLOGY

Envelope Area to TFA	3
Surface Area to Volume	32
Envelope Area to Glazing	14%
South Glazing	47%
Enclosure R Value	36.2

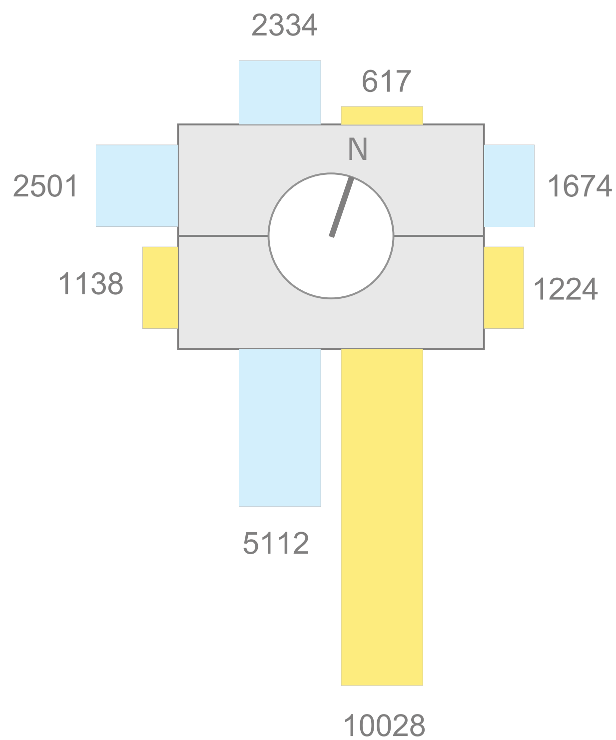
OPERATING EXPENSE

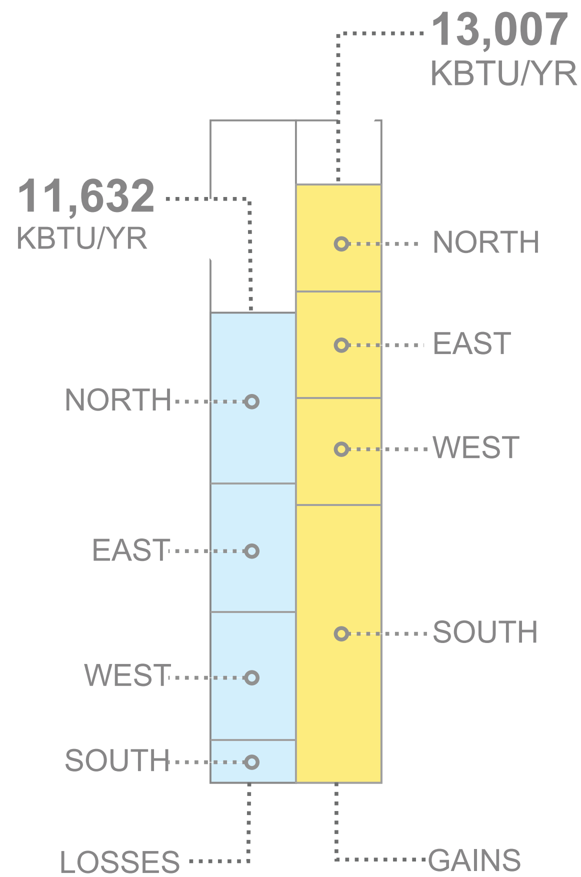


PASSIVE HOUSE	TYPICAL HOUSE
$1,056 YR	**$2,800 YR**
$88 MO	$233 MO
$2.90 DAY	$7.76 DAY



GLAZING GAINS AND LOSSES BY ORIENTATION





RPA

PUBLISHED ARTICLE

Green Building Advisor.com

IS OSB AIRTIGHT?

Green Building Advisor
December 12, 2014 - UPDATED on August 13, 2015
Martin Holladay, GBA Advisor; Musing of an Energy Nerd
****an excerpt from the article****

Link below to view full article :
http://www.greenbuildingadvisor.com/blogs/dept/musings/osb-airtight

Builders And Researchers In North America And Europe Report That Air Can Leak Right Through Oriented Strand Board

Richard Pedranti is an architect in Milford, Pennsylvania. Pedranti recently sent me an e-mail describing his headaches with Weyerhaeuser OSB.

"The project where we experienced OSB air leakage is a new residence that my office designed to meet the Passive House standard," Pedranti wrote. "The project started construction in June of 2014 and is located in Scranton, Pennsylvania. It's my first Passive House project, and I was concerned above all else about reaching the aggressive airtightness requirement of 0.6 ach @50 Pa. … Our team spent a great deal of time making sure the construction was tight and sealed. The OSB is taped on the outside with Siga Wigluv. The top floor is a flat ceiling with the OSB fastened to the bottom of the roof trusses and then taped with Siga Wigluv. The contractor took it upon himself to foam every interior stud and plate. …The polyethylene vapor barrier [was] wrapped up from beneath the concrete slab and taped to the OSB with Siga Wigluv."

So far, so good. Pedranti explained in an e-mail, "After starting the blower door and spending several hours sealing small leaks, it became clear to me the we were not going to get close to 0.6 ach @50 Pa. The lowest we measured was 1.1 ach @50 Pa."

I telephoned Pedranti for more details, and he explained, "We had been pretty confident that we were going to pass the blower-door test with flying colors. We got the blower door in, and we started at over 1.5 ach50 early in the day. We were in there for 4 or 5 hours with a fog machine. We were using flashlights, tape, and foam, finding every leak we could. The consultants and contractors were all working hard and sweating. After a few of hours, we were reaching the point of diminishing returns. It was becoming clear that we weren't going to get below 1 ach50. We were done."

When the house was pressurized, the poly billowed out.

"We were all quite frustrated at that point, and our building performance consultant, Pete Vargo, suggested doing a positive pressure test and looking around outside," Pedranti wrote in his e-mail. "We reversed the fan and Pete said, 'Let's do a balloon test on the OSB just for fun.' We taped a piece of polyethylene over a portion of the OSB and taped it with Siga Wigluv. The polyethylene immediately ballooned up just like the shroud of the blower door, and Pete declared that we have leaky OSB."

"We have leaky OSB."

Pete Vargo, building performance consultant

Balloon test #2 over OSB panel only

Pedranti explained over the phone, "I wasn't very excited to do this balloon test. I didn't think it was true that the OSB was leaking. I thought it had to be the tape seams or the sill seal at the plate. We taped the poly up there and cranked the fan up, and it just happened instantaneously. We said, 'This is unbelievable. How did we end up with this leaky OSB?' I was quite upset."

"Bummer"

After observing these tests, Pedranti started asking questions. "When I returned to my office, I e-mailed a number of Passive House colleagues including Adam Cohen, Mike Kernagis, Dan Whitmore, and Chris Corson. They all had the same reaction: 'Bummer — I've heard of this happening before.' Dan suggested several liquid-applied solutions including Dow Corning Defendair 200, BASF Enershield, Prosoco Cat-5, and elastomeric paints."

Solving the problem by painting the OSB with elastomeric paint wouldn't be as easy as it sounds. "One limitation to our solution is that we did not want to remove the Siga Wigluv, which is a water-based tape," Pedranti wrote.

"After a cost and labor analysis, we opted for Siga Majpell [a European air barrier membrane that installs like housewrap] applied over the OSB with Siga Twinet. Twinet is a double-face adhesive tape. The Siga Majpell was also applied to the second floor ceiling."

In our phone conversation, Pedranti said, "It cost $3,000 to fix the problem, and the contractor didn't charge that much for labor. The double-sided tape is expensive." After the new air-barrier membrane was installed over the OSB, a blower-door test showed an air leakage rate of 0.34 ach50 — well below the Passivhaus target of 0.6 ach50.

Pedranti will never again use Weyerhaeuser OSB. "I have changed the sheathing specification in future Passive House projects to Zip sheathing to avoid this issue."

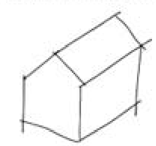
After hearing Pedranti's story, I spoke with Alex Kuchar, Weyerhaeuser's OSB technical manager, and asked him whether Weyerhaeuser has tested the airtightness of their OSB. "No, we have not," Kuchar responded.

Duclose Method

TEST 1

Initial test after slab/wall/ceiling close in

Prior to windows and door cutouts



Target benchmark	
< 10,000 CF	.25 ACH50
10,000 – 20,000 CF	.20 ACH50
20,000 – 30,000 CF	**.15 ACH50**
>40,000 CF	.10 ACH50

TEST 2

Second air test after window and door installation

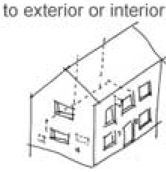
Prior to exterior or interior insulation

Target benchmark	
< 10,000 CF	.45 ACH50
10,000 – 20,000 CF	.40 ACH50
20,000 – 30,000 CF	**.35 ACH50**
>40,000 CF	.30 ACH50

TEST 3

Third air test after MEP installation

Prior to exterior or interior insulation



Target benchmark	
< 10,000 CF	.60 ACH50
10,000 – 20,000 CF	.55 ACH50
20,000 – 30,000 CF	**.50 ACH50**
>40,000 CF	.45 ACH50

GREEN BUILDER®
BUILDING A BETTER WORLD

PENNSYLVANIA PERFORMER

Green Builder Magazine
March / April 2018
Alan Naditz
****an excerpt from the article****

2017 PASSIVE HOUSE OF THE YEAR

Link below to view full article :
https://www.greenbuildermedia.com/design/10th-annual-green-home-of-the-year-award-winner-pennsylvania-performer

To Achieve Passive House Status for Scranton House, Builders Went Back to Basics.

Once upon a time, there was a burned-out house on an abandoned hillside lot—an eyesore for residents of Scranton, Pa. You'd never know that today. The site is now where a two-story, 2,153-square-foot "state of green" house now rests. And the city, the home's owners and its developers couldn't be happier.

The home is Northeastern Pennsylvania's first residence designed and constructed to Passive House standards. It's also a triumph for architect Richard Pedranti and builder Rob Ciervo, both of whom have never developed a passive house before.

Passive houses, in general, are rare in the U.S. The Scranton Passive House is only the 112th Passive House Institute U.S. (PHIUS)-certified home in North America.

"There were a lot of first experiences in this project for everybody," Pedranti says. "But we had a great group; a great team. Everyone was really excited to do this."

Simple, Sensible Tastse

In 2014, when owners Declan Mulhall and Christie Karpiak—professors at the nearby University of Scranton—approached Pedranti about replacing the destroyed Wheeler Avenue structure with an actual house, they had a straightforward request: Make a home that was ultra-energy efficient and practical in terms of living space. At the time, Mulhall was adamant that he did not want a "McMansion" full of "useless space," such as a formal dining area and sitting rooms.

"Christie and Declan were very much about sustainability," Pedranti recalls. "They were definitely looking to lower their carbon footprint—build something that didn't have a negative impact on the environment and the natural resources. Beyond that, they wanted a very simple home to raise their family in."

Pedranti had achieved LEED certification years before, but had yet to actually attempt anything in that venue. "[With this project, LEED] was a very positive way to take my business, and it was exciting," he says. "I really liked that it is based on science. I have found over the years that a lot of the bad things in our industry are the result of an overemphasis on pure aesthetics."

Trial and Air-on

Some energy goals were easier to attempt than others. The house faces south for maximum solar energy gain. The arbor provides shade during the summer to keep out unwanted heat. Solar panels on the shed northwest of the screened porch generate on-site energy that will help the home meet net-zero status.

A RenewAir EV200 heat recovery ventilator was installed to draw fresh air from outside, and pre-heated or cooled air from indoors. Blown cellulose insulation, made primarily of shredded newspaper, was installed in the ceiling (R-90) and walls (R-60) to prevent loss of that temperature-treated air during transfer. Pedranti says they went way above Passive House minimums during installation.

To stop heat loss through the concrete floor, Pedranti originally planned to use a typical 12-inch layer of expanded polystyrene and 8 inches of crushed gravel. But then a person familiar with PHIUS suggested replacing the gravel with perlite. "I never would have thought of it," he says. "It has an R-value of 3.5, it's environmentally safe, and it was being made in [nearby] Bethlehem [Pa]. It comes in 8-inch bags. We used it, and our slab went from R-40 to R-75 at very little cost. I never realized it could be that easy."

Not everything was as cut and dried. Knowing that achieving the Passive House designation depended on the home being airtight, Pedranti and Ciervo set out to make what amounted to an airtight box. "Everything had to be perfect, especially since we had an airtightness requirement of 0.6 ACH50," Pedranti notes. "Your 'box' or envelope gives you a baseline. Then, every time you make a hole in the envelope—such as a window or door—you have an idea of the amount of leakage."

After accounting for the planned openings and sealing obvious escape areas, the team used a blower door and a fog machine to detect where any other leaks might be. Any leaks found were promptly patched up with foam and vinyl tape.

"This simple, traditional PHIUS design offers a clear path to a solid, sustainable home."

From the Green Builder Magazine Judges

"The first time were tested, we were certain we were going to pass," Pedranti recalls. "When we failed, it was shocking. After all, it was a box!" They never achieved better than 1.1 ACH50, far short of the minimum, he notes. On a whim, the team put a piece of polyurethane over a portion of the Oriented Strand Board (OSB) sheathing in use, reversed the blower door and discovered that the problem was the OSB itself. "Sure enough, there was air leaking through the OSB," Pedranti says. "We were not happy. But we solved our problem by putting a membrane over the sheathing."

That reduced the home's airtightness score to 0.34 ACH50—well under Passive House standards. The home's overall HERS Index score is 28, a number that the homeowners are certain will improve as other energy-saving efforts come online.

"I knew when I got into Passive House, there was a hard learning curve, which has everything to do with the fact that you measure things. That's not the case with a typical, prescriptive code-built home," says Pedranti, who has since taken on other Passive projects. "With Passive, you build an energy model with a spreadsheet. It's very detailed; it's down to three digits. Every bit of material, the design, the orientation of the windows—all that stuff is either 'yes' or 'no' in terms of meeting the requirements. For me, it's well worth the extra effort."

MATERIALS & SUPPLIES VENDORS

- PHIUS — Passive House Institute US
- PH — Passive House Alliance United States
- Blue Ridge Fiberboard®
- Energy Star
- GE
- Insulation Corporation of America
- Intus Windows
- Millbrook — Cabinetry & Design —
- Mitsubishi Electric — Cooling & Heating
- NF — National Fiber — Professional Cellulose for Cellulose Professionals
- Pennsylvania Perlite Corporation
- SIGA
- RenewAire® — Energy Recovery Ventilation — The Natural Choice for Fresher Air
- retrotec
- Teragren® — Fine Bamboo Flooring, Panels & Worktops
- Zero Energy Ready Home — U.S. Department of Energy

SCRANTON PASSIVE HOUSE CREDITS

OWNERS
Christie Karpiak & Declan Mulhall

ARCHITECT
Richard Pedranti Architect

ENERGY CONSULTANT
Nu-Tech Energy Solutions
Pete Vargo

CERTIFICATION
PHIUS
Lisa White, Certification Manager

CONTRACTOR
Ciervo and Sons, Renovations
Rob Ciervo

PHOTOGRAPHY
Rick Wright Photography

PUBLIC RELATIONS
Broadpath PR
Gretchen Roede
Robert Kries

The **Scranton Passive House** is the 112th PHIUS Certified Passive House in North America.

RPA

SCRANTON PASSIVE HOUSE

Scranton Passive House