

Passive House In Affordable Housing

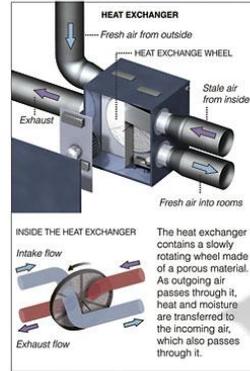
Kevin Brennan and Gerald Abt

Association for Energy Affordability, Inc.

What is Passive House?

At the Heart, A Heat Exchanger

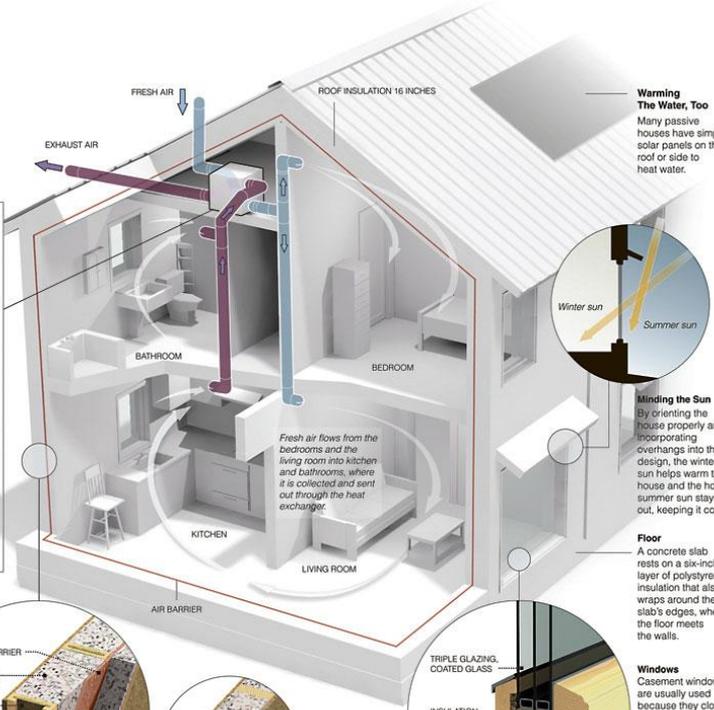
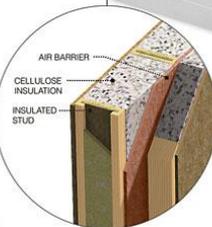
The most important element in keeping a passive house warm is the heat exchanger, which uses heat from inside air to warm fresh air from outside. Stale air is constantly being replaced with fresh air; about one-third of the house's air is replaced every hour.



Keeping the Heat In

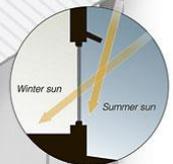
Exterior walls are two or three times thicker than those in a conventional house and are well insulated, with the amount of insulation varying by climate. A double-wall system is used, with a continuous air barrier between the two walls. Walls and studs are designed to minimize heat conduction.

PASSIVE HOUSE WALL, 12-INCH TOTAL INSULATION



Warming The Water, Too

Many passive houses have simple solar panels on the roof or side to heat water.



Minding the Sun

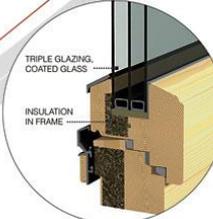
By orienting the house properly and incorporating overhangs into the design, the winter sun helps warm the house and the hot summer sun stays out, keeping it cooler.

Floor

A concrete slab rests on a six-inch layer of polystyrene insulation that also wraps around the slab's edges, where the floor meets the walls.

Windows

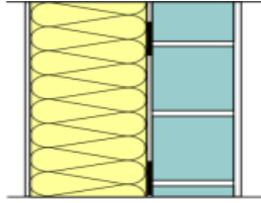
Casement windows are usually used because they close tighter than other types. Coated glass helps reflect heat back inside the house in winter and keeps some heat out in summer.



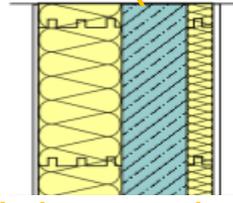
Performance Standard

- Airtightness 0.6 ACH50
- Super Insulation R-30 walls
- Triple Pane Windows R-11
- ERV / HRV ventilation
- 4.75 kbtu Heating Demand
- Thermal Bridge Free
- PHPP = Quality Design

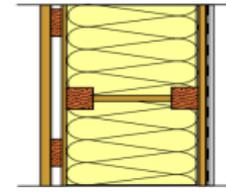
Passive House-suitable external wall constructions: $R \geq 37.85 \text{ (hr.ft}^2 \cdot \text{° F)/Btu}$



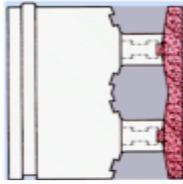
a) Masonry with EIFS
 (thickness > 250mm (10in))



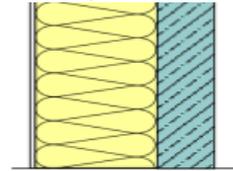
b) Formwork element made of rigid polystyrene 240+120+60mm or (9½+4¾+2⅓in)



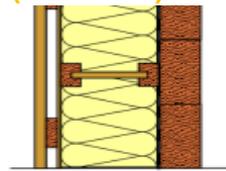
c) light-weight: plywood I-beam, fully insulated 300-400mm (12-15¾ in)



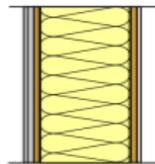
d) Formwork element on expanded clay basis 375mm (14 ¾in)



e) Prefabricated porous concrete element



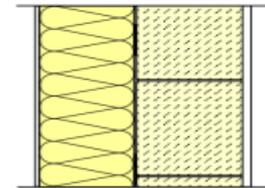
f) thick timber board wall



g) Prefabricated polyurethane sandwich elements 200mm (8in)

h) Hightech: VIP* 25mm (1in)

λ around 0.0022 W/(mK) or (R around 65.55 hr.ft² F/BTU)



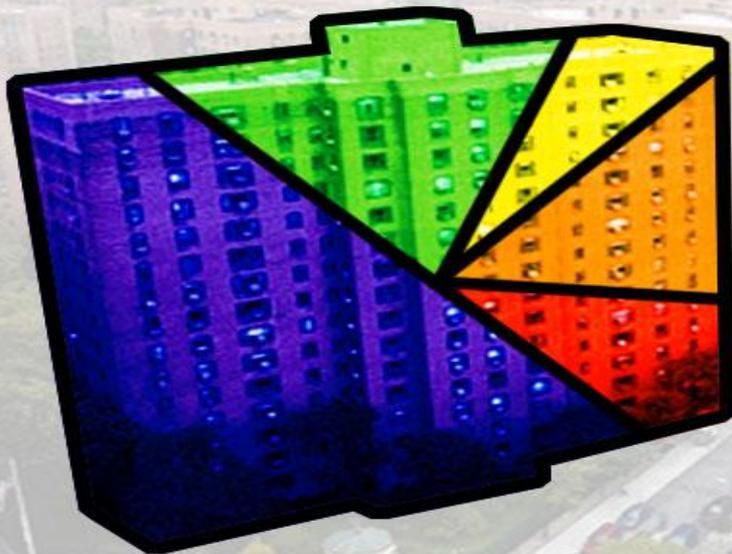
i) Porous concrete blocks with mineral foam insulation



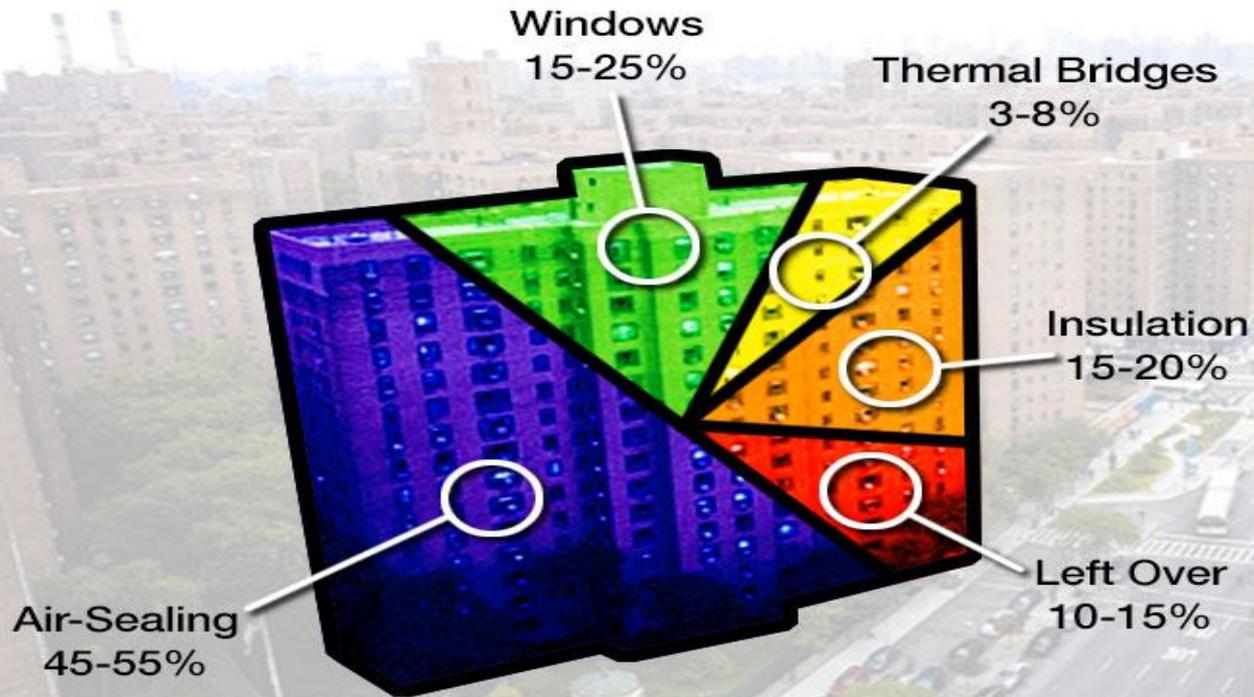
Low Income Housing in NYC

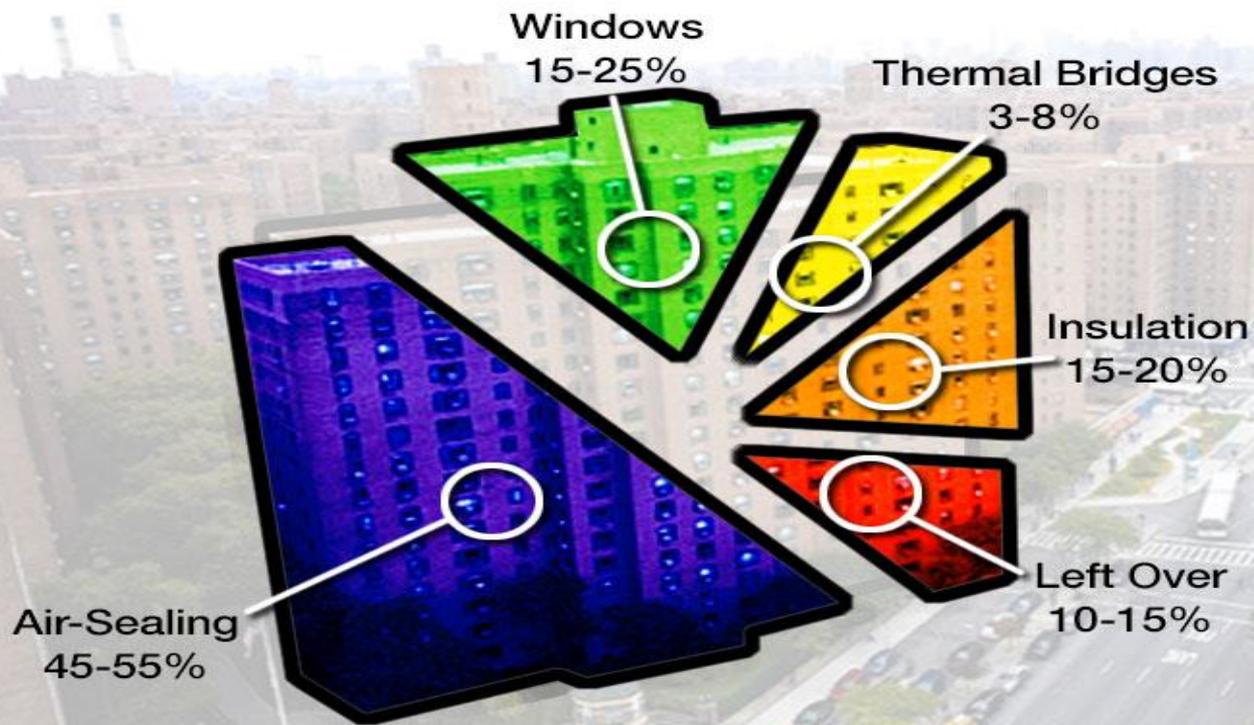


Performance breakdown.

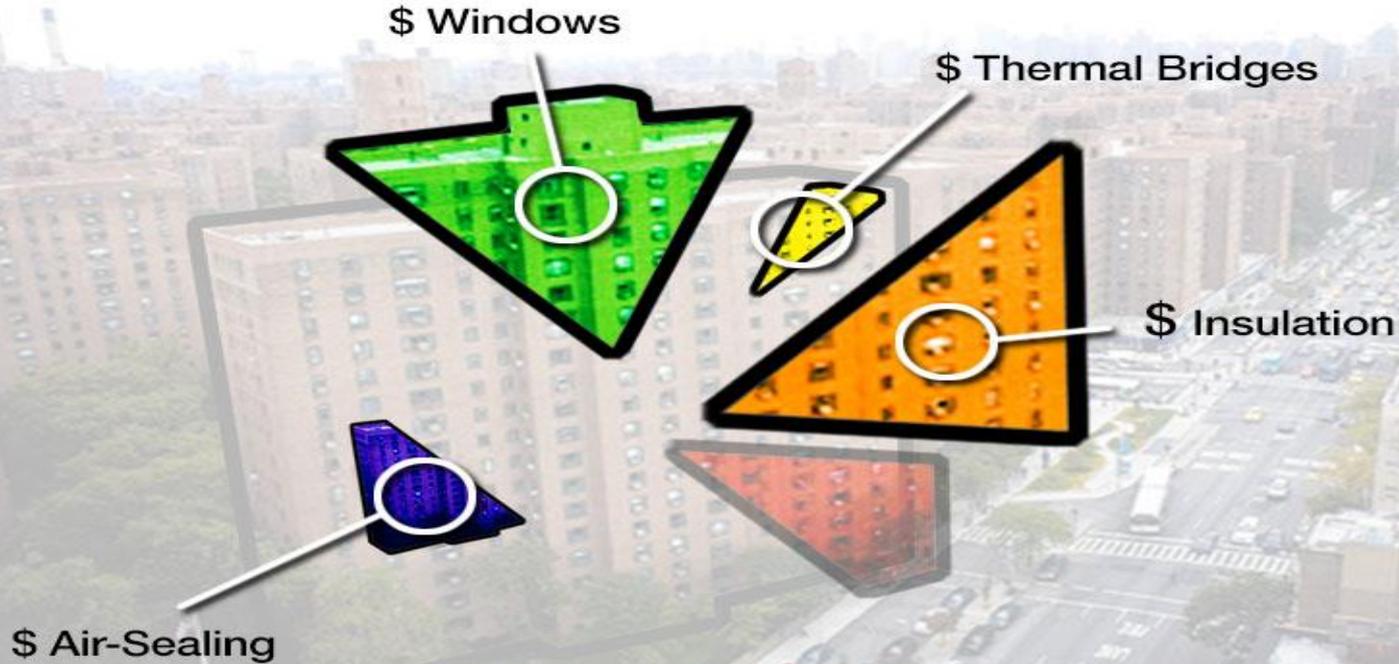


Passive House





Thermal Components: How much do they cost?





-90%

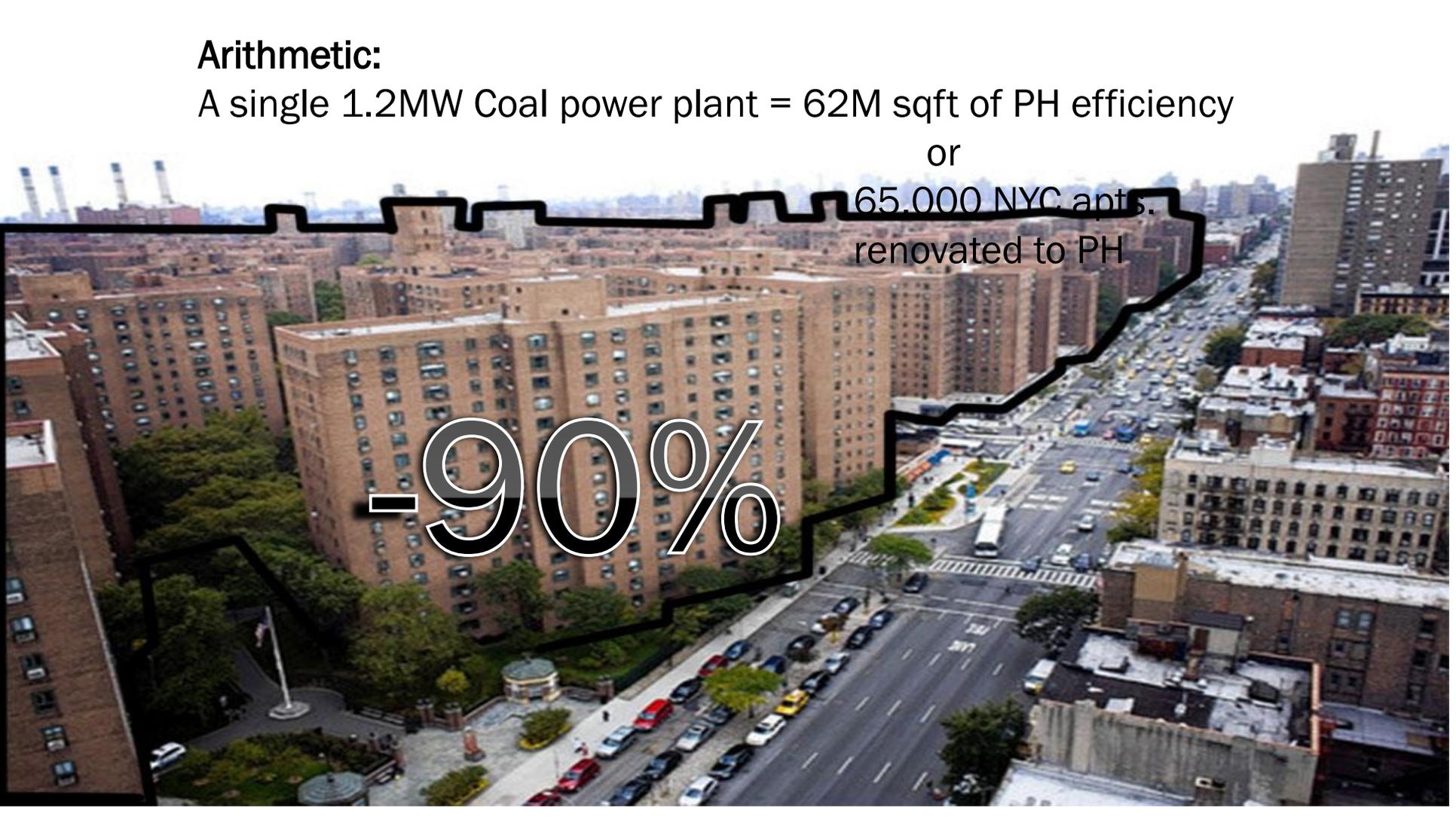
Arithmetic:

A single 1.2MW Coal power plant = 62M sqft of PH efficiency

or

65,000 NYC apts.
renovated to PH

-90%

An aerial photograph of a dense urban area, likely New York City, showing numerous multi-story brick apartment buildings. A large, irregular black outline highlights a specific block of buildings in the center-left. Overlaid on this highlighted area is the text '-90%' in a large, white, outlined font. In the background, several industrial smokestacks are visible against a hazy sky. The foreground shows a busy street with cars and a bus.

Arithmetic:

A single 1.2MW Coal power plant = 62M sqft of PH efficiency

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65,000 NYC apts
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-90%



1st Certified Passive House Project in New York City



Architect: Julie Mosckovitz
PH Consultant: Jordan Goldman
Contractor: WM Dorvillier & Co

Certified by Passive House Academy

**Airtightness of 0.3
ACH on a 100+ year
old building**



Apple to Apples



Brighton Green

KEY ATTRIBUTES

- ENERGY CONSERVATION
- SHADING AND GLAZING DEVICES TO PREVENT SOLAR HEAT GAINS
- SUPER INSULATION FOR RETENTION OF SPACE CONDITIONING ENERGY
- GEOTHERMAL AIR COOLING SYSTEM

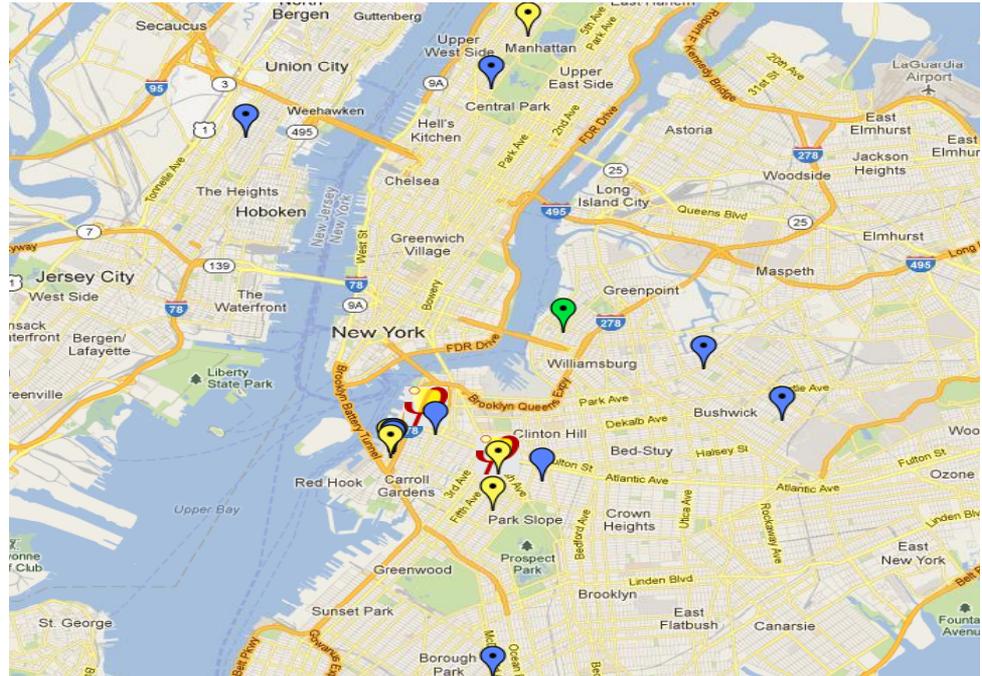
SYSTEM INTEGRATION



NY Passive House Mapping Project: +240,000sqft

NYPH

New York Passive House



Onion Flats Philadelphia

- 126 Units
- Modular Construction
- Equal to traditional construction costs
- 200 kW Solar array
- Green Roof



Adam J. Cohen

Hickory Hall Emory and Henry College



	Sq Ft	Cost	Cost / Sq Ft
Elm Hall	36,000	\$ 4,500,000.00	\$ 125.00
Hickory Hall	40,000	\$ 4,730,000.00	\$ 118.25

Passive House Budget

Investment on the left reduces costs on the right

Windows

Insulation

Air Sealing

Costs less per
efficiency unit gained



Ventilation

Mechanical

Costs more per
unit implemented

Next training opportunities for Designers & Trades



June 24th 2013 NYC



May 23rd 2013 NYC

Questions?

Thank you!

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