



# **PNC SmartHome Cleveland: A case study of public education, community involvement and passive house design**

David Beach, Cleveland Museum of Natural History  
North American Passive House Conference, October 18, 2013

# The assignment

Design a house that respects the architectural character of an historic Cleveland neighborhood and will sell in the Cleveland market.

Assure that it meets the Passive House standard, the world's most rigorous home energy performance standard.

Construct it so it that it will work well as a museum exhibit — and also so the whole house can be picked up and moved to another site.

Involve scores of volunteer contractors and suppliers in the building process.

And build it in just two months, including the rainiest April in Cleveland history.





Wade Park Avenue, Cleveland, Ohio



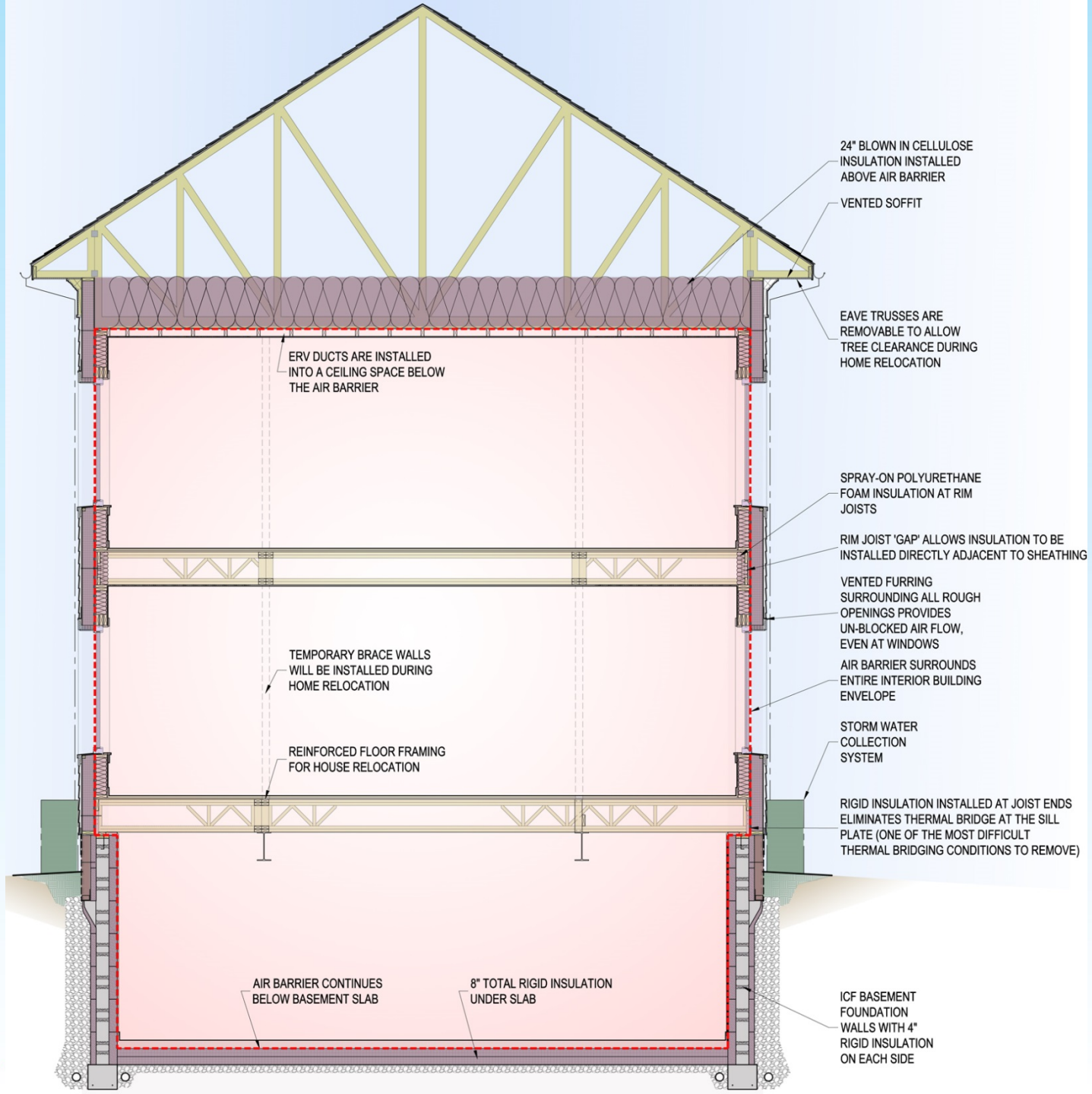


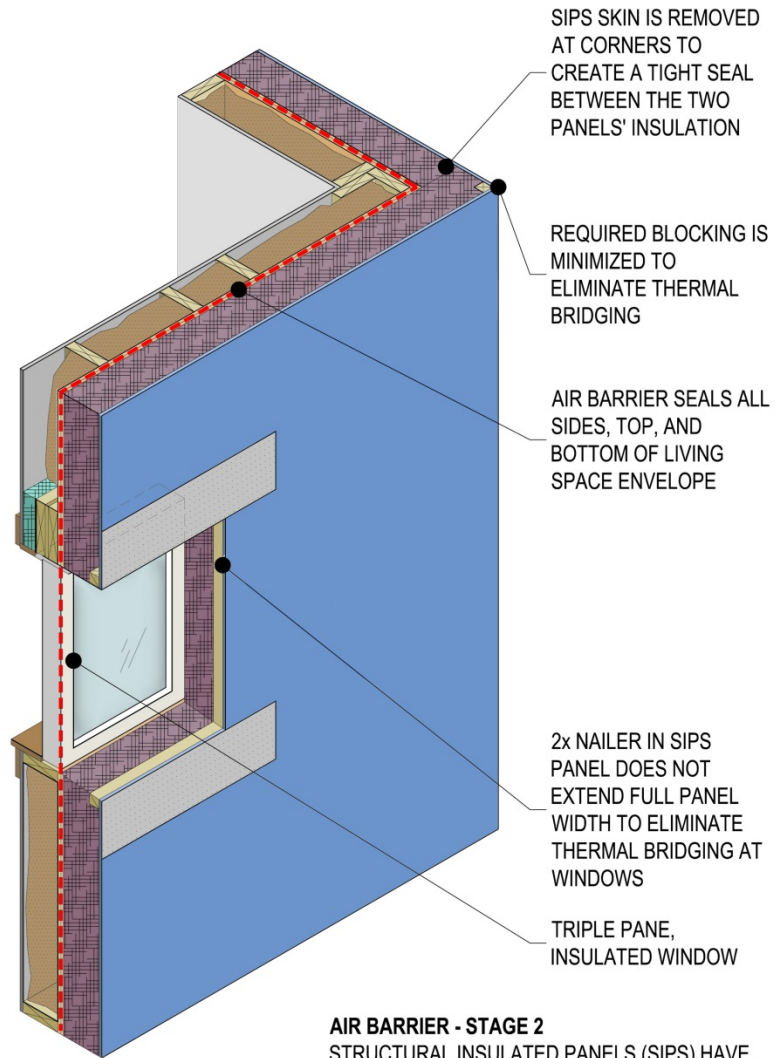
First Floor Plan



Second Floor Plan



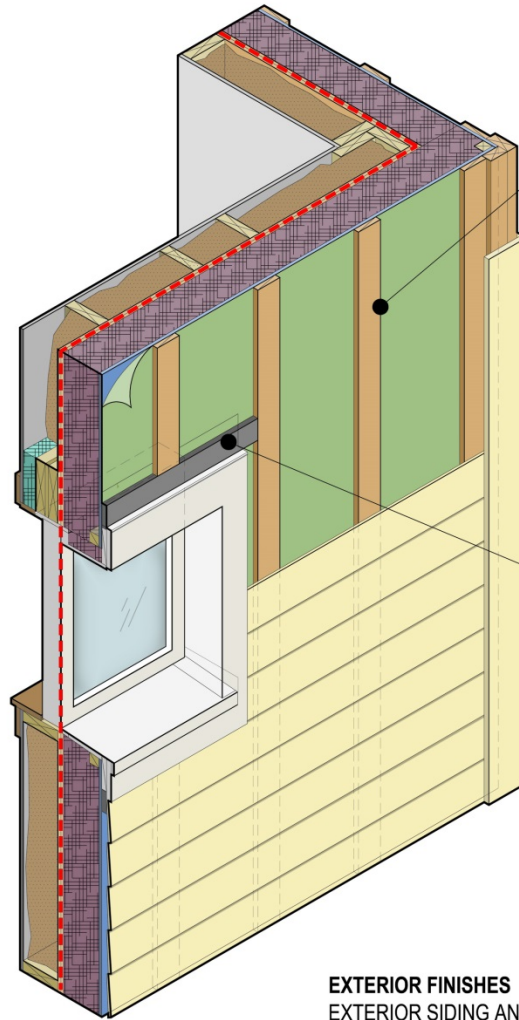




**AIR BARRIER - STAGE 2**

STRUCTURAL INSULATED PANELS (SIPS) HAVE BEEN PRE-FABRICATED AND ARE APPLIED OVER THE OSB SHEATHING. THIS CREATES THE CONTINUOUS AIR BARRIER THAT SEALS ALL FOUR SIDES OF THE HOUSE AS WELL AS THE UNDERSIDE OF THE ATTIC & BASEMENT SLAB.





WOOD FURRING STRIPS  
SPACED 16" APART  
PROVIDE A DRAINAGE  
PLANE AND ALLOW  
FREE AIR FLOW BEHIND  
THE SIDING

VENTILATED FURRING  
STRIP AT TOP AND  
BOTTOM OF WINDOWS  
AND WALLS ALLOWS  
AIRFLOW, EVEN WHERE  
NORMAL HORIZONTAL  
FURRING WOULD  
BLOCK AIRFLOW

#### EXTERIOR FINISHES

EXTERIOR SIDING AND TRIM ARE APPLIED. THE DESIGN OF THE EXTERIOR MATCHES THE ARCHITECTURAL CHARACTER AND STYLE OF THE OF THE ADJACENT HOMES







































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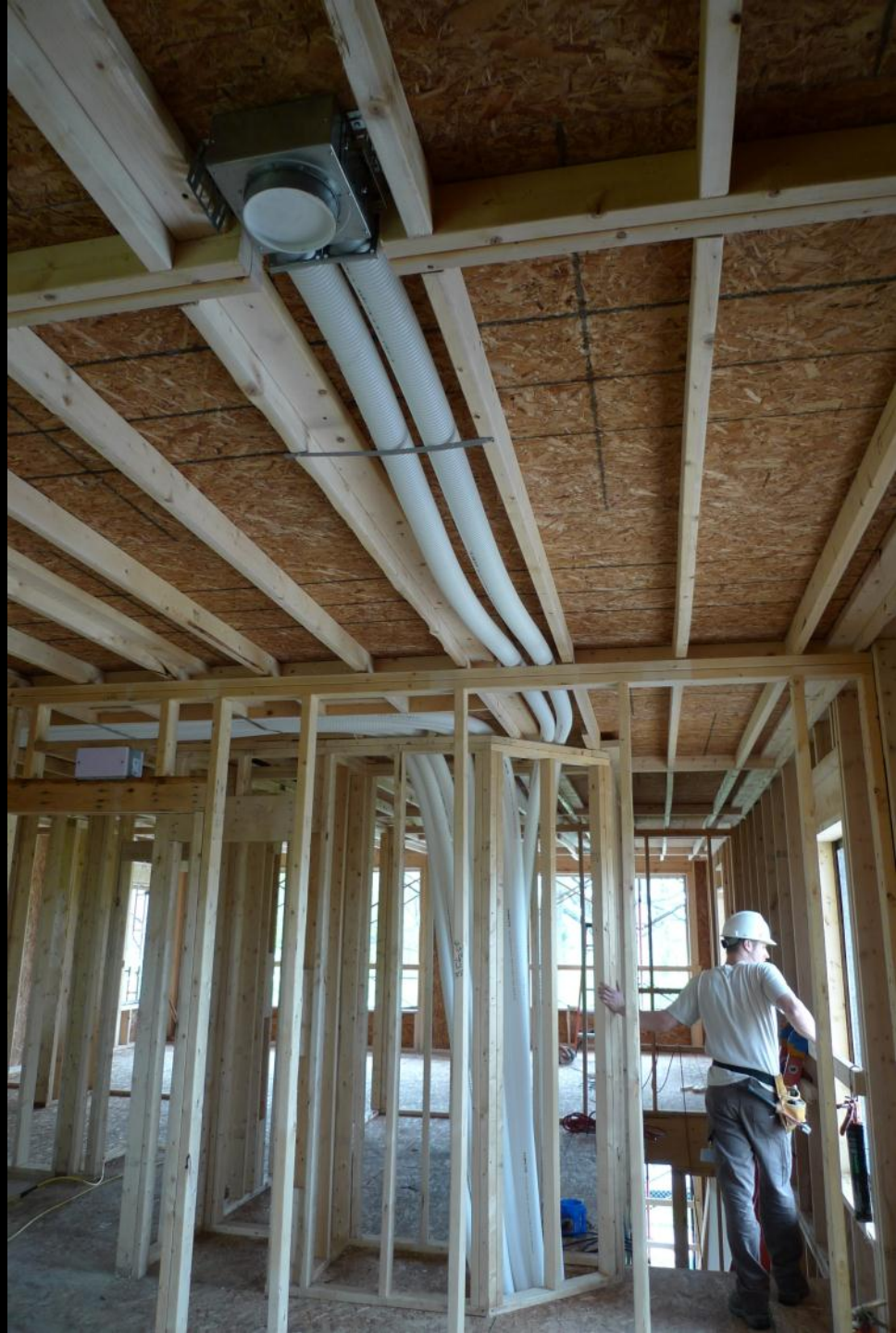






























# Principles of passive house design

- Superinsulation (R-50 walls)
- Eliminate thermal bridges
- Make it airtight
- Specify energy or heat recovery ventilation
- Specify high-performance windows and doors
- Optimize passive-solar and internal heat gains
- Model energy gains and losses using Passive House Planning Package
- Design for local climate







# Special tours

American Institute of Architects  
American Society of Home Inspectors  
Association of Energy Engineers Northern Ohio  
Chapter  
Biomimicry Educators Summit  
Boys Hope Girls Hope  
Brush High School  
Case Western Reserve University SAGES  
Channel 8- Kickin it with Kenny  
Cleveland Botanical Gardens  
Cleveland Green Building Council  
Cleveland Heights Public Officials  
Cleveland State University Summer in the City  
Collegiate Sustainable Practices Consortium  
Construction Specification Institute  
Cool Cleveland  
COSE, Council of Small Enterprises  
Cuyahoga Community College  
Detroit Shoreway Community Development  
Doan Brook Watershed Partners  
EHOVE Career Center  
Energy Efficiency & Technology Magazine  
Enterprise Community Partners  
Famicos Foundation neighbors  
Generation Foundation  
Greater Cleveland Healthy Homes Advisory  
Council  
Gund Foundation Trustees

Habitat for Humanity  
Hawken School  
John Carroll University  
John Hay High School  
Lead Safe Living  
Midview High School  
Montessorri High School at University Circle  
National Association of Women in  
Construction  
National Inventors Hall of Fame STEM School  
( Akron)  
National Solar Tour  
Neighborhood Progress Inc.  
Northeast Ohio Regional Sewer District  
PNC Bank  
Senator Mike Skindell  
Senator Rob Portman's Office  
Shaker Heights High School  
Sherwin Williams  
Snavelly Building Company  
South Franklin Circle  
Summit County Metroparks  
Summit County Executive  
University Circle Inc.  
University of Michigan Cleveland Alumni Club  
Uptown Business Association

(Partial list as of 9/12/11)



# Science concepts

- Geometry of heat transfer
- Insulation and thermal bridging
- Heat exchange ventilation
- Astronomy and passive solar design
- Waste reduction
- Water quality and conservation
- Native plants
- 90% carbon reduction









The Cleveland  
Museum of  
NATURAL HISTORY

SIDEWALK  
CLOSED

PANZICA























## PNC SmartHome impacts

- **Community** – First certified Passive House in Ohio; new conversations about climate change, green building, energy efficiency and affordable housing
- **Neighborhood** – Investment in University Circle
- **Visitors** – Thousands of people experienced attractive, practical ways to save energy and reduce carbon emissions
- **CMNH** – Image as center of innovation and sustainability with a focus on the future, media coverage valued at \$1.14 million, AAM award for creativity in museums





Julia Kuo, *100 Days in Cleveland*



# SmartHome participants

AA House Movers  
A Piece of Cleveland  
Advanced Fiber Technology  
All Crane Rental  
American Lighting Association  
Anonymous  
APG Office Furnishings  
Ardmore Tree Service  
B&B Wood Products  
Best Supply  
Bill Amick Drywall  
Judy Brandon  
Judy Carlson  
Cattman Tile  
Cerino and Sons Landscaping  
CertainTeed  
City of Cleveland  
Cleveland Botanical Garden  
The Cleveland Foundation  
Cleveland Magazine  
Cleveland Public Power  
Cleveland Vicon  
Johnny Coleman  
Comfort Systems USA  
Continental Fire & Security  
Corsi Landsape  
Councilman Kevin Conwell  
Countryside Plumbing  
CPK Construction  
Doan Brook Watershed Partners  
Doty & Miller Architects  
Dovetail Solar & Wind  
DY Timberframing  
Ebersole Ltd.  
EcoWatch  
Edge Lighting  
Edelman Plumbing Supply  
Energate Windows

Enterprise Community Partners  
F. Buddie Contracting  
Famicos Foundation  
Fiberon  
Fomo  
Suzie Frazier  
Fresh Look Painting  
Rosalyn Gaier  
Fred Gearhart  
GE Lighting  
Giambrone Construction  
W.R. Grace Construction Products  
GreenStreet Solutions  
H Windows  
Habitat for Humanity of Greater  
Cleveland  
Bradley Hart  
Hartman Electric  
HarvestBuild Associates  
Freddy Hill  
Holophane Lighting  
Home Depot (Brooklyn, OH store)  
William Houghton Fund  
Howard Hanna Real Estate  
John Hoy & Associates  
Hunter Douglas  
Michel Ina  
Insulation Systems  
InterfaceFLOR  
Intwine Energy  
Klyn Nurseries  
Knight & Stolar  
KraftMaid Cabinets  
Kramer Development Group  
Tricia Lazuka  
Charlotte Lees  
Logix ICF Walls  
Lutron Electronics  
Mars Electric Supply

Liz Maugans  
Nicole McGee  
Terry McGowan  
Mentor Lumber & Supply  
Metro Hardwoods  
Mr. Excavator  
Mitsubishi Electric HVAC U.S.  
Moen  
National Construction Rentals  
Neighbor to Neighbor Block Club  
Neighborhood Progress Inc.  
Steve Nissen and Linda Butler  
Timothy J. Norris & Associates  
Northeast Ohio Regional Sewer  
District  
Ohio Desk  
Panzica Construction  
Phoenix Concrete  
The Plain Dealer  
PNC Bank  
Red Dot Project  
RePower Solutions  
Nancy Richards-Davis  
Rosby Resource Recovery  
Royal Landscape  
Tremco/RPM  
Schluter Systems  
Sherwin-Williams  
Stark Truss  
Stoneworks  
The G.B. Storer Foundation  
Sunflower Solutions  
SureTight Insulated Panel  
Corpotation  
Third Federal Savings and Loan  
Timan Custom Window Treatments  
Time Warner Cable  
Toto USA  
Unilock

University Circle Inc.  
U.S. Consolidated  
Virginia Tile  
Vizmeg Landscape  
Waco Scaffolding  
Waid's Rainbow Rental  
Wallrus Wall Systems  
Warren Roofing  
WCPN/WVIZ ideastream  
Zehnder  
Chris Zielski

*As of 5/8/2011*



# Design-build team

Doty & Miller Architects

CPK Construction

HarvestBuild (Passive House consultant)

Panzica Construction

Comfort Systems USA

Knight & Stolar Landscape Architects



# GreenCityBlueLake

THE CLEVELAND MUSEUM OF NATURAL HISTORY



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