

Introduction to Passive House

SJC Collaborative Network
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Discussion Topics:

- **What is Passive House?**
- **Benefits of a Passive House Construction**
- **Five Basic Principles of Passive House**
- **Frequently Asked Questions**
- **Additional Resources**
- **Appendix**

What is Passive House?

Passive House Main Objectives:

Passive House optimizes fundamental building components to achieve:

- Unsurpassed interior **comfort** and **air quality**
- Heating and cooling energy reduction of **up to 90%**

The reduction in energy costs makes this a cost effective solution from day one.

First Passive House:

Passive House concept was advanced in the early 1990s by Dr. Wolfgang Feist. First optimized Passive House Prototype built in 1990 in Kranichstein, Germany. More than 40,000 buildings since, resulting in the most tested and most rigorously verified building standard.



Real Benefits of Passive House Construction

1. Costs:

- Up to 90% reduction heating and cooling
- Modest initial cost for dramatic utility savings long term

2. Comfort and health:

- Optimal temperature and humidity for personal comfort at all times
- Highest indoor air quality due to filtering systems
- Reduced impact of exterior ambient noise
- Consistent temperature regardless of environmental changes
- Elimination of pesticide use as pests are not able to access the house

3. Predictability

- Data driven energy design, for optimal performance
- Resiliency – Maintains living temperature during emergency grid failure

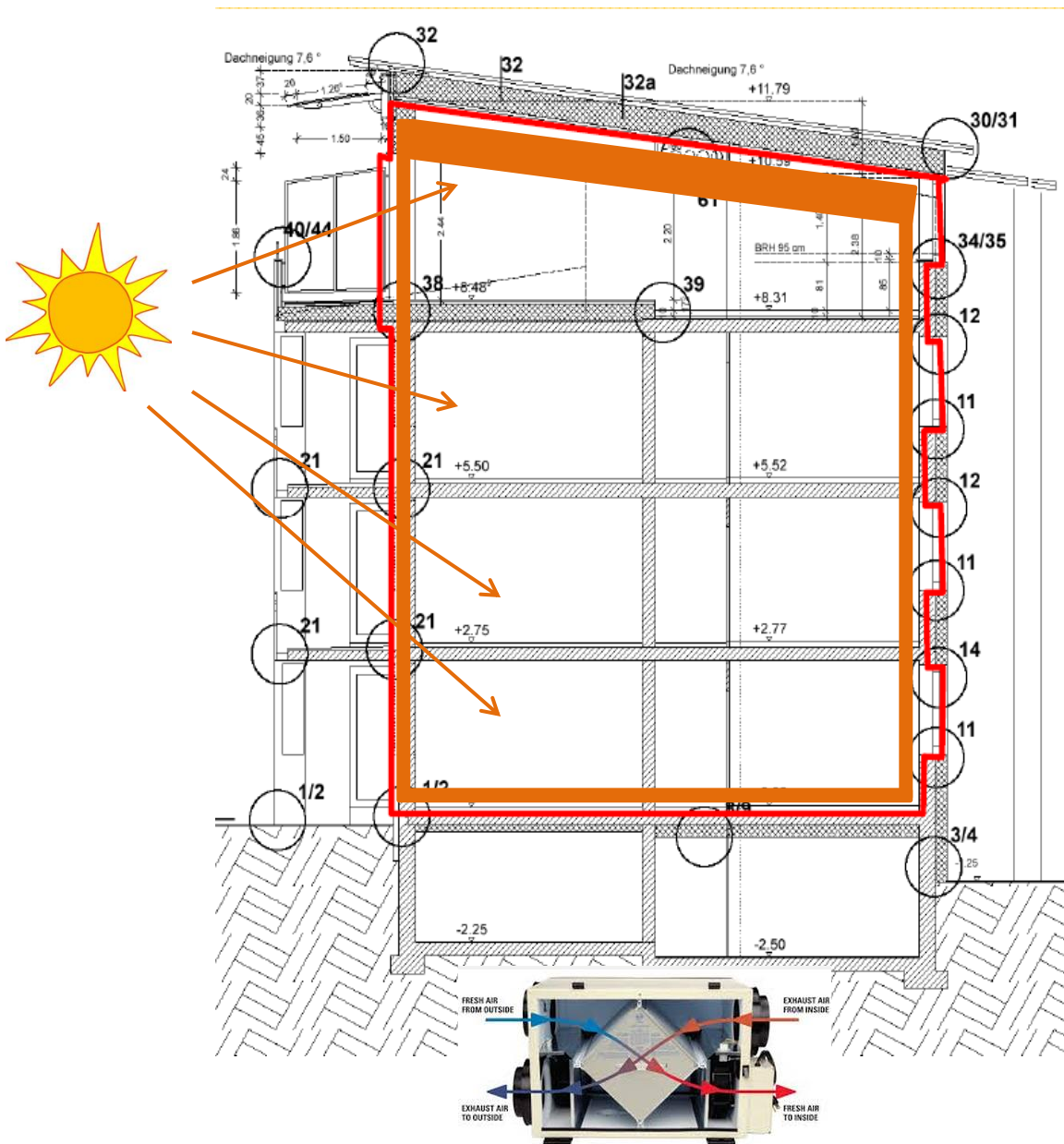
4. Environmental Impact

- Reduces global warming footprint by 90%

5 Basic Principles to Achieve Passive House Standard

- **Air-tightness** - a layer to prevent uncontrolled movement of air between external and internal environments
- **Ventilation and filtration system:**
 - 24/7 Fresh air exchange using Energy Recovery Ventilator (ERV) that recovers energy from outgoing air and conditions incoming air to reduce energy loss
 - Filtration of contaminants – dust, VOC, pollen, odors
 - Stable humidity
- **Thermal Insulation** – optimal insulation minimizes energy consumption by 70-90% and requires 50-60% smaller HVAC equipment resulting in:
 - 50-60% savings in initial HVAC purchasing costs
 - Additional savings in maintenance due to lower use
- **Thermal Bridge Free Connections**
 - Elimination of conduction of exterior temperatures into the interior of the house, thus preserving constant temperatures
- **Passive House Windows**
 - Provide heat to the house from the sun
 - Prevents energy loss

5 Basic Principles to Achieve Passive House Standard -Illustration

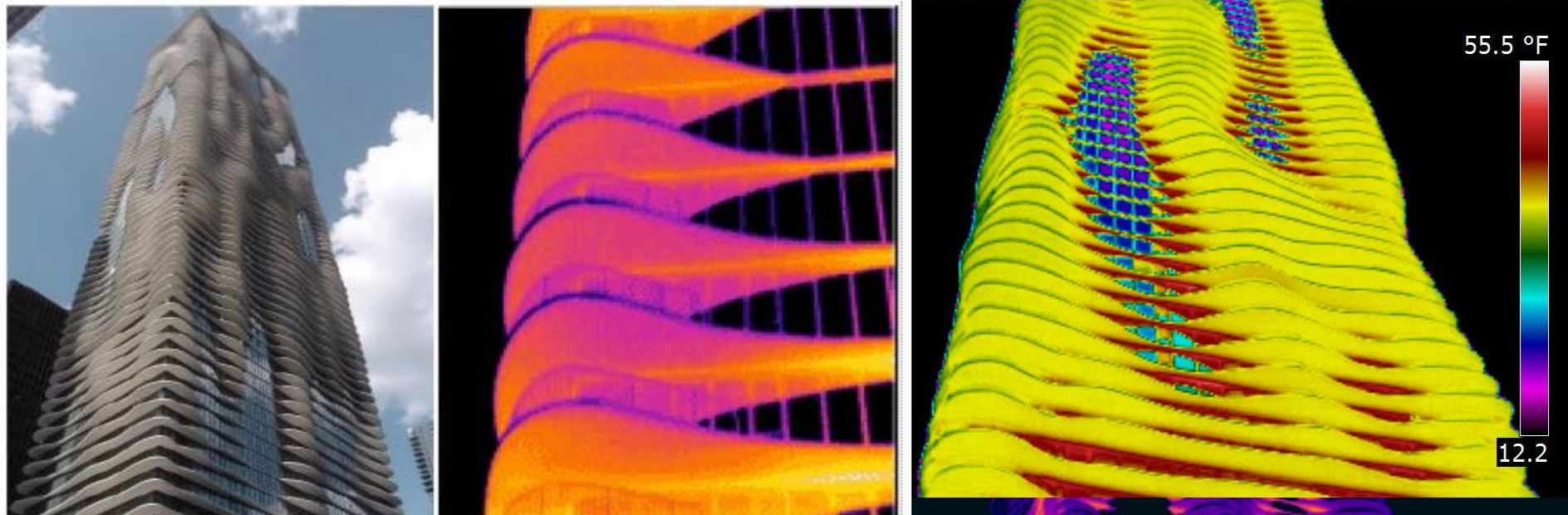


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5 Basic Principles to Achieve Passive House Standard –Thermal Bridge

A thermal bridge is an area of extreme heat transfer caused either by a conductive material crossing through an insulation layer or a geometric transition in the thermal boundary. Commonly found at studs, plumbing penetrations, steel beams, and balconies, thermal bridges can significantly reduce the overall R-Value of an assembly. Passive House buildings are thoughtfully designed to eliminate thermal bridges, thereby mitigating energy loss.

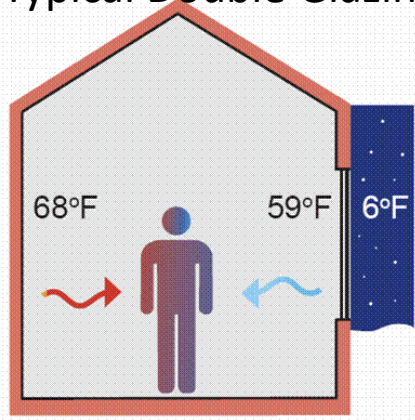
See below for a commonly used example showing the extreme heat transfer through cantilevered balconies on the Aqua tower in Chicago.



Source: Building Science Corporation Newsletter #49: Aqua Tower and Infra Red by Fluke Corp

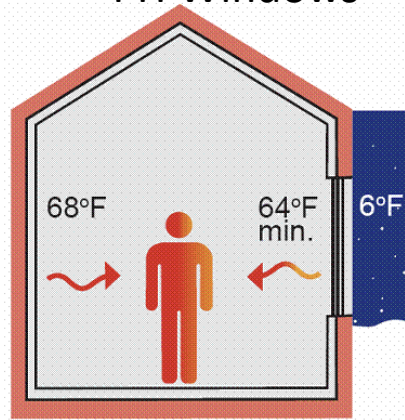
5 Basic Principles to Achieve Passive House Standard –Windows

Typical Double Glazing



Discomfort

PH Windows

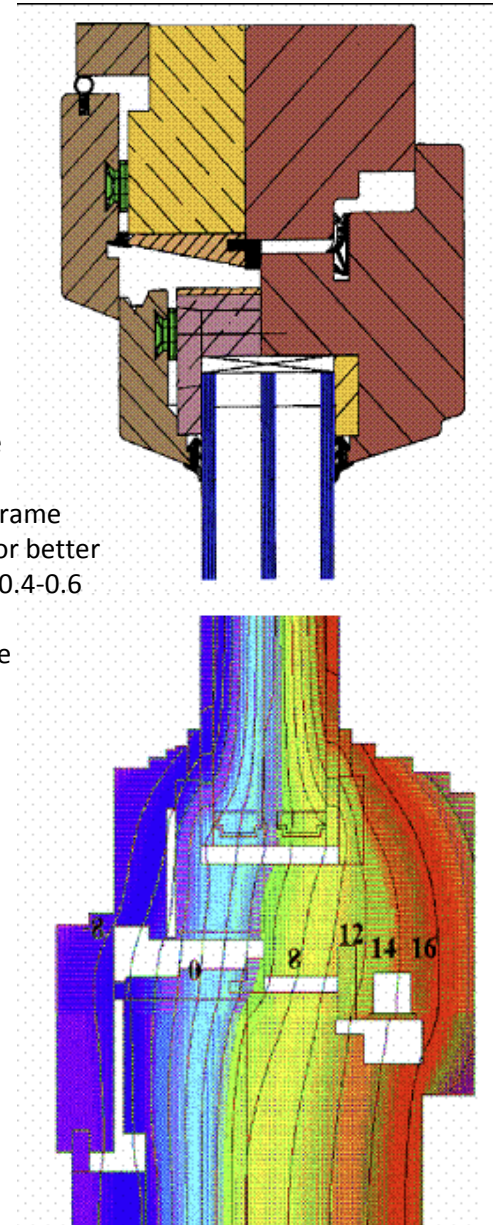


Comfort



Cost mostly attributed to the operable frame, so large fixed windows are cost efficient

- Triple pane (glazing)
- Insulating frame
- R6 overall or better
- high SHGC 0.4-0.6
- high visual transmittance



Frequently Asked Questions

- **How do costs for PH compare to regular construction costs?**
 - *Standard evolved from research experiments in which European scientists sought to calculate a balance point below which the installation of more insulation provided a measurable return on investment, and above which more insulation returned no economic benefit*
 - *Much cheaper HVAC equipment,*
 - *Ongoing savings*
- **Are the materials too exotic and difficult to find?** –*The standard requires no specific products. However, it is easier to design a Passive House using assemblies that have been modeled and windows that have been certified to meet Passive House guidelines. These products are now readily available in the U.S. and Canada.*
- **Is it more complicated to build a PH than a regular house?** *Here's the Passive House standard in a sentence: Heating load ≤ 3.17 Btu/ft², annual heating demand ≤ 4.75 kBtu/ft², annual primary energy demand ≤ 38 kBtu/ft², thermal bridging $\Psi \leq 0.006$, airtightness ≤ 0.60 ACH@50Pa. That's it. Passive House is like hockey: It's a simple game with a steep learning curve. It's an experience that is easier (and more fun) with an experienced team.*

Frequently Asked Questions

- **How do I build my own Passive House?** *Select Passive House Consultant or work with Architect who is also certified as a passive House Consultant or is interested in building a Passive House*
- **Are there any restriction of the type of house I can build or where?**
There are no restrictions on the type of house, shape, new or historic retrofit, or location. See examples below:



Additional Resources:

Organizations providing educational opportunities

- Introductory Seminars
- Passive House Consultant & Tradesperson Training
- Advanced specialization(PHPP, Thermo bridge Modeling)
- Certification



Additional Resources



www.nypassivehouse.org



www.passivehouse-international.org



www.naphnetwork.org



www.passivehouse.com

Events

Date/Time

Get NYSERDA Financial Incentives for Your Passive House Project <i>TRESPA Showroom, New York</i>	Wednesday, February 4, 2015 6:30 pm - 7:30 pm
R-951 Open House- All system Operational <i>951 Pacific, Brooklyn NY</i>	Saturday, February 7, 2015 2:00 pm - 6:00 pm
Knowledge, experience, community – all found here: Building Energy 15 <i>Seaport world trade center, Boston MA</i>	Tuesday - March 3, 2015 Thursday - March 5, 2015
19 th International Passive House Conference <i>Congress-Center, Leipzig, Germany</i>	Friday, April 17, 2015 Saturday, April 18, 2015
NAPHN Conference & Expo 2015 <i>Hyatt Regency, Vancouver BC</i>	Thursday, October 1, 2015 Friday, October 2, 2015
12 th International Passive House days <i>New York & New Jersey tri-state area</i>	Friday, November 13, 2015 Sunday, November 15, 2015

Appendices:

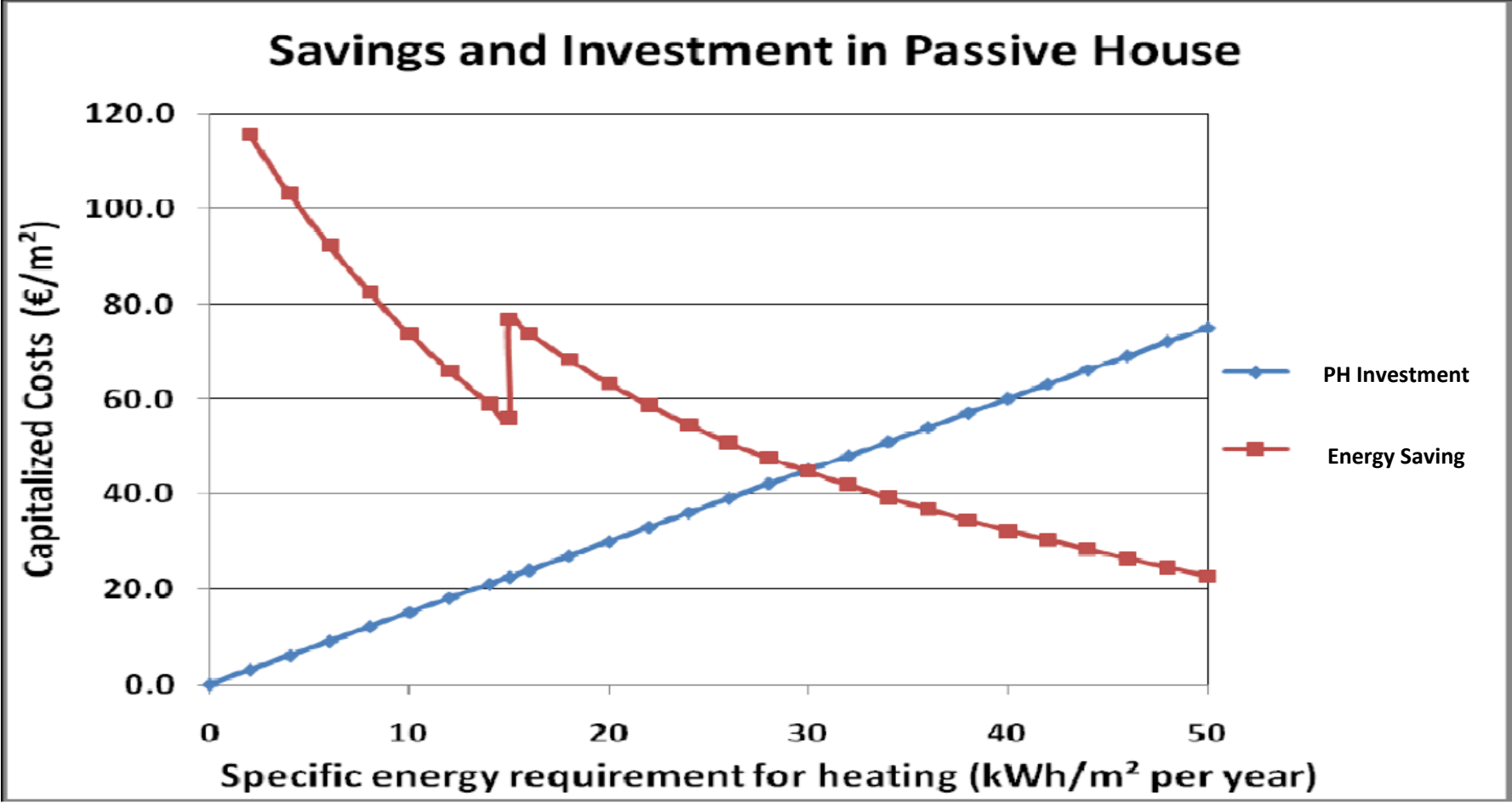
- A. PH & Building Science**
- B. Cost/Benefit analysis to defined PH standard**
- C. Ecology and Economy**

Metrics & Requirements

- Annual Heating Demand $\leq 4.75\text{kBtu/ft}^2\cdot\text{year}$
- Annual Cooling Demand $\leq 4.75\text{kBtu/ft}^2\cdot\text{year}$
- Annual Primary Energy Demand $\leq 38\text{kBtu/ft}^2\cdot\text{year}$
- Heating load $\leq 3.17\text{Btu/ft}^2$

- Air Leakage $\leq 0.6 \text{ ach}@50\text{Pa}$

International Energy Agency



Note: Costs are for central Europe (Germany)

(Source: IEA Information Paper: Energy Efficiency requirements in Building Codes, Author Jens Laustsen)

Appendix C: Worldwide Energy Resources and Consumption cont'd

U.S. Energy
quads

The Transition

energy productivity remains constant

