Non-Residential Passive House

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Rhode Island Energy™
a PPL company

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Energy code
technical support

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Code Compliance Enhancement Initiative

- Free Energy Code Technical Support is available by calling **1-855-343-0105**
- The Rhode Island Energy Code Technical Support Initiative aims to:
  - Improve energy conservation code compliance through educating code officials and industry professionals
  - Establish higher compliance by offering a competitive stretch code
  - Take on an active role in the policy and advocacy of matters related to energy code

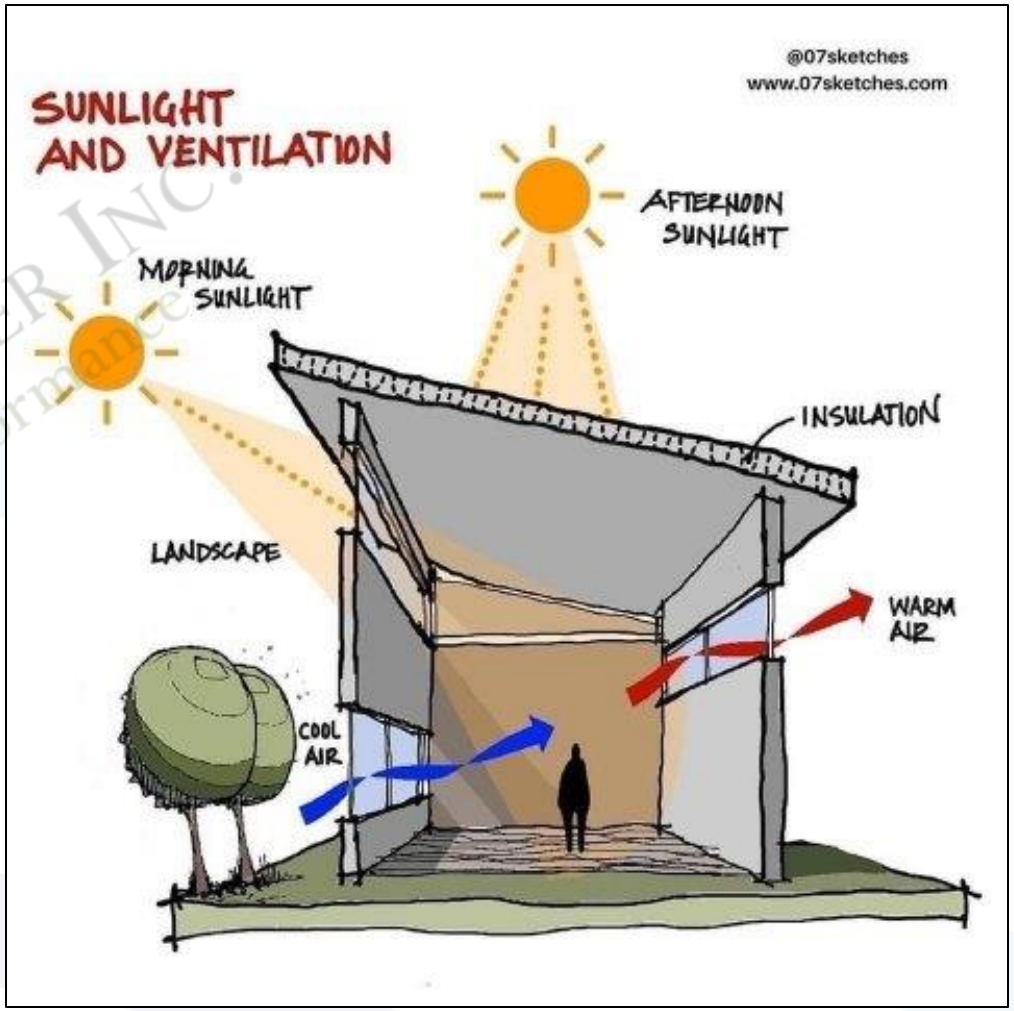
Disclaimer

These trainings are being offered through the support of Rhode Island Energy, and in cooperation with the Rhode Island Building Code Commission. The Energy Code Technical Support staffs are not code officials, and the information provided through the program is not a formal interpretation of the code. Your local code official is responsible for the enforcement of the code and the Rhode Island Building Code Commission is the governing body responsible for interpretations of the code.

Learning Objectives

Learning Objective 1	Understand the principles of the Passive House rating system
Learning Objective 2	Become familiar with the requirements and criteria of Passive House
Learning Objective 3	Recognize the benefits and challenges of implementing Passive House
Learning Objective 4	Gain practical insights into Passive House design and construction

What is Passive Design?



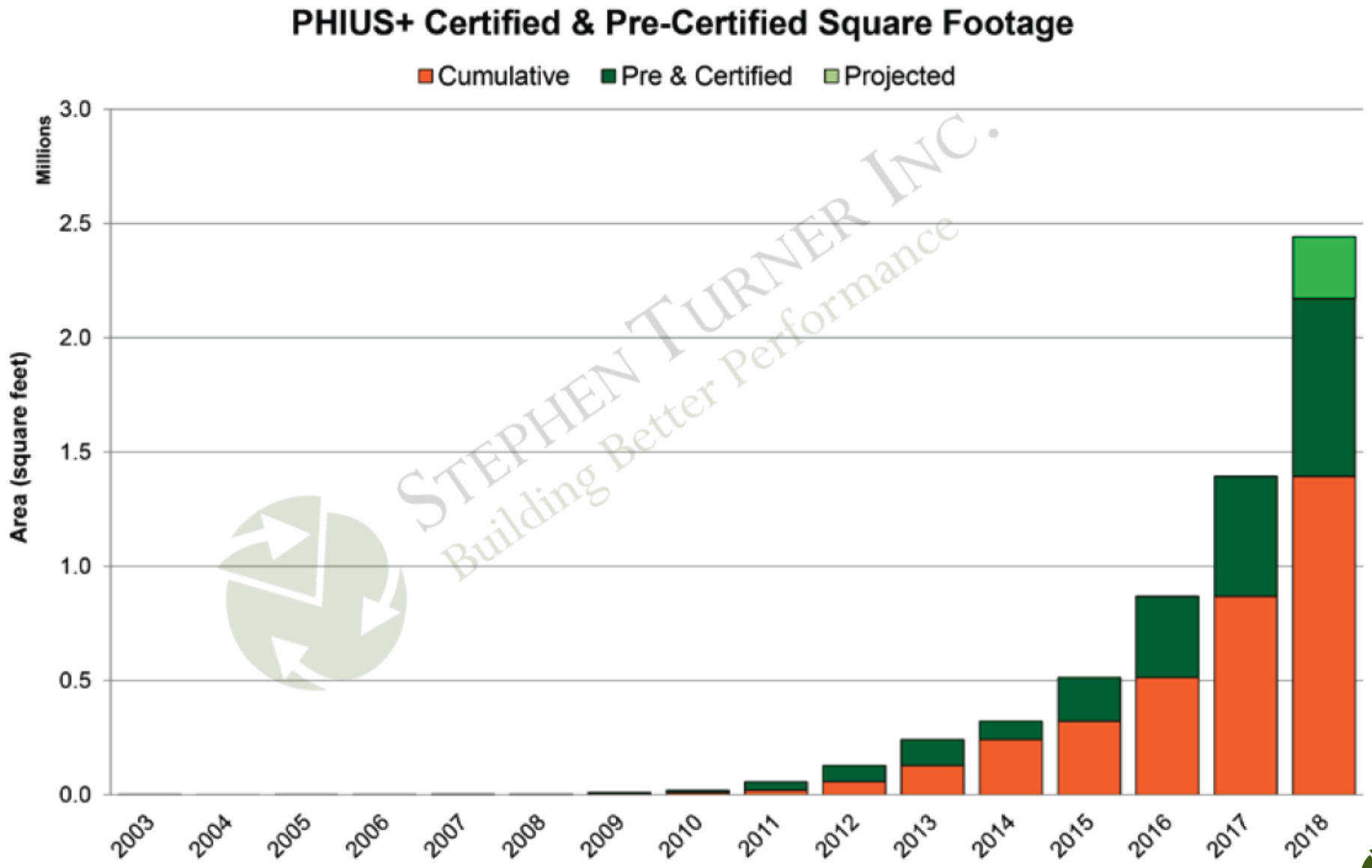
Sources: Energy.gov, BBC

What is a Passive House?

The Passive House **certification** formalizes these principles and ensures that they are fully achieved in design/construction projects.

> *Passive building is a **set of design principles** for attaining a **rigorous level of energy efficiency** while also creating **comfortable indoor living spaces**. These principles can be applied to **all buildings**, including single-family homes, multifamily apartment buildings, schools, skyscrapers and more.*
>
> *– PHIUS*

Growth of Passive House



Source: PHIUS Multifamily Design Guide

Examples of Non-Residential Passive House Certified Buildings

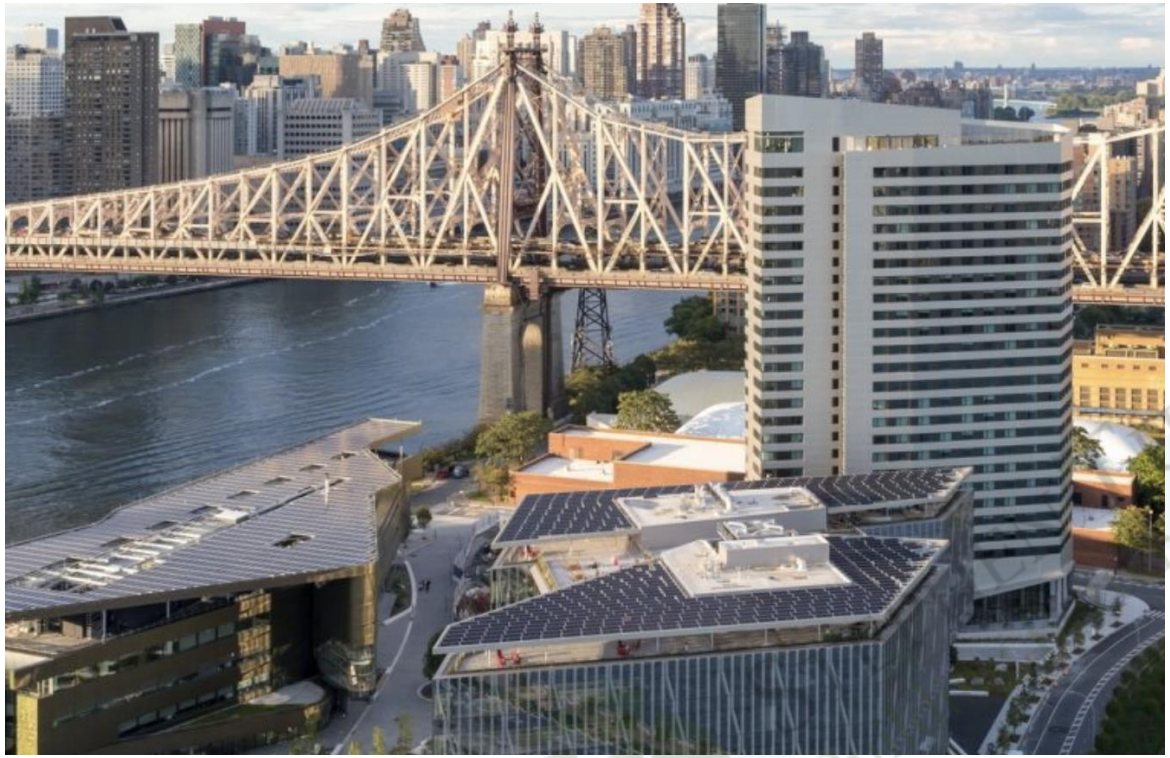


Photo: Handel Architects

The House was the largest and tallest residential building in the world built to Passive House standards when it was completed in 2017

Photo: New Ecology

Finch Cambridge – the city's largest affordable housing project built in the last 40 years

Examples of Non-Residential Passive House Certified Buildings

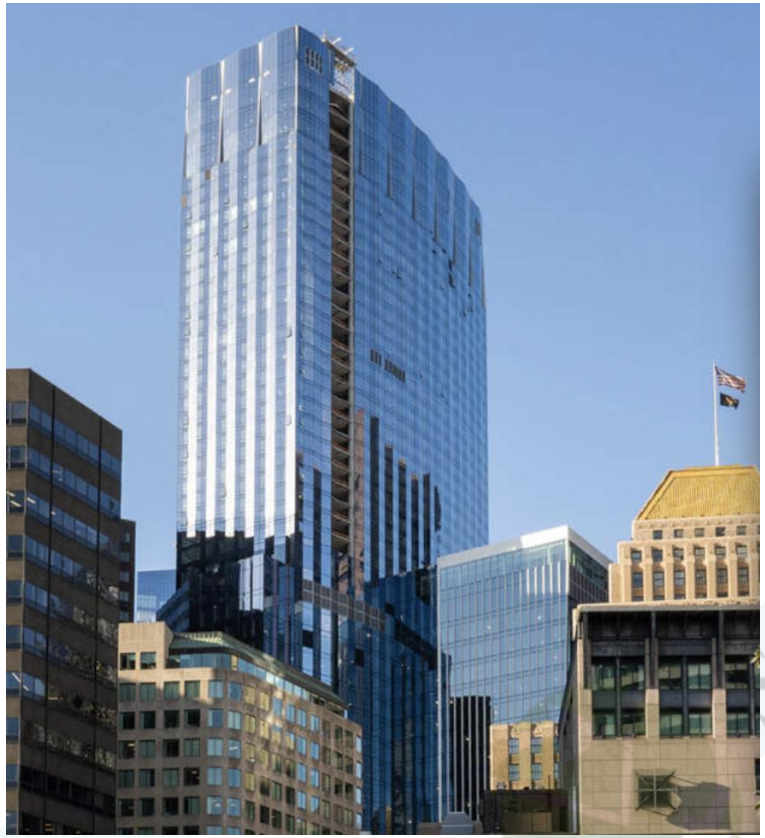


Photo: MP Boston

Winthrop Center, Boston

Photo: PHIUS

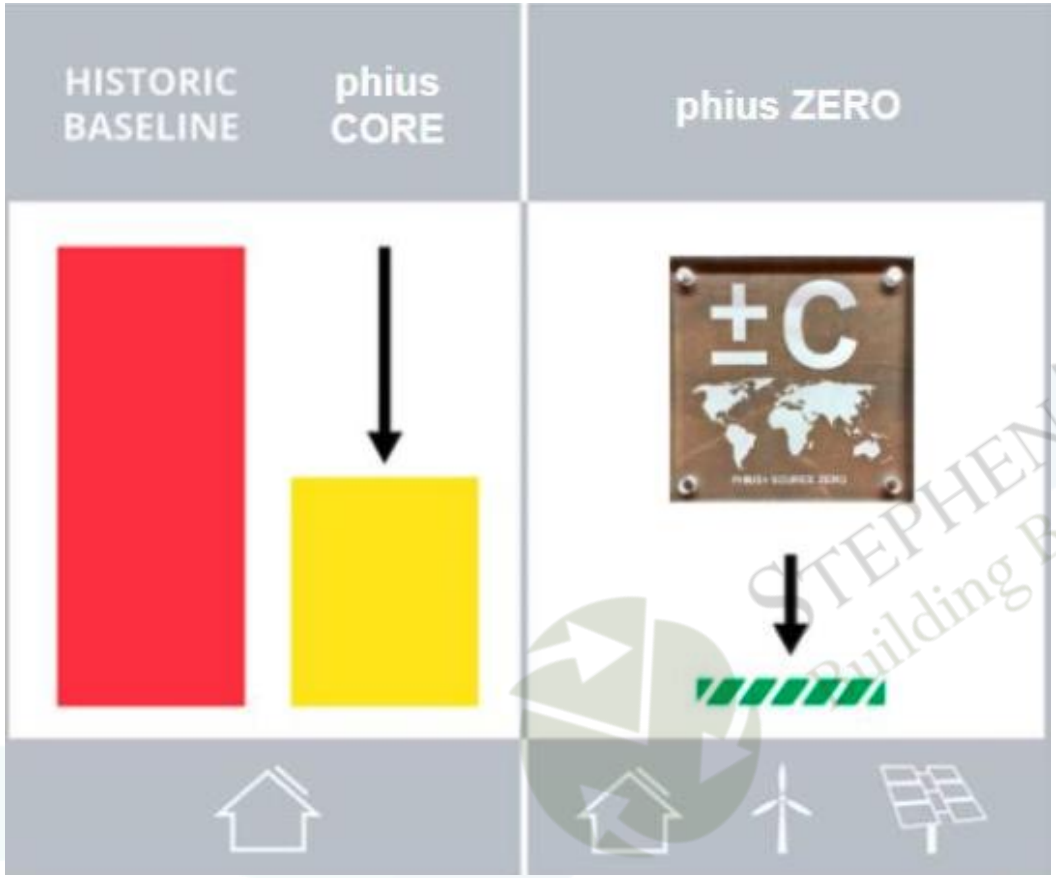
RMI Innovation Center

Massachusetts Multifamily Passive House Examples

Source: phmass.org

Figures shown in image are incremental project costs

Passive House vs LEED Certifications



Source: phius.org

LEED

- Focus on general sustainability
- Four tiers – Certified, Silver, Gold, Platinum

Passive House

- Focus on energy reductions
- Two tiers – CORE, ZERO

Passive House vs LEED Differences - Example

LEED

Location & Transportation
Up To:14 Points

Sustainable Sites
Up To: 9 Points

Water Efficiency
Up To: 10 Points

Energy and Atmosphere
Up To: 35 Points

Materials & Resources
Up To: 14 Points

Indoor Environmental Quality
Up To: 15 Points

Innovation
Up To: 6 Points

Regional Priority Credits
Up To: 4 Points

VS.

PASSIVE HOUSE

Overall Source Energy Allowed
38.1 kBtu/ft²/yr

Heating Energy Allowed
Max 4.75 kBtu/ft²/yr

Cooling Energy Allowed (NY)
Max 5.39 kBtu/ft²/yr
(region specific)

Air Changes per Hour (ACH) through the facade @ 50 pascals of pressure
0.6 ACH
5-10 times higher than typical

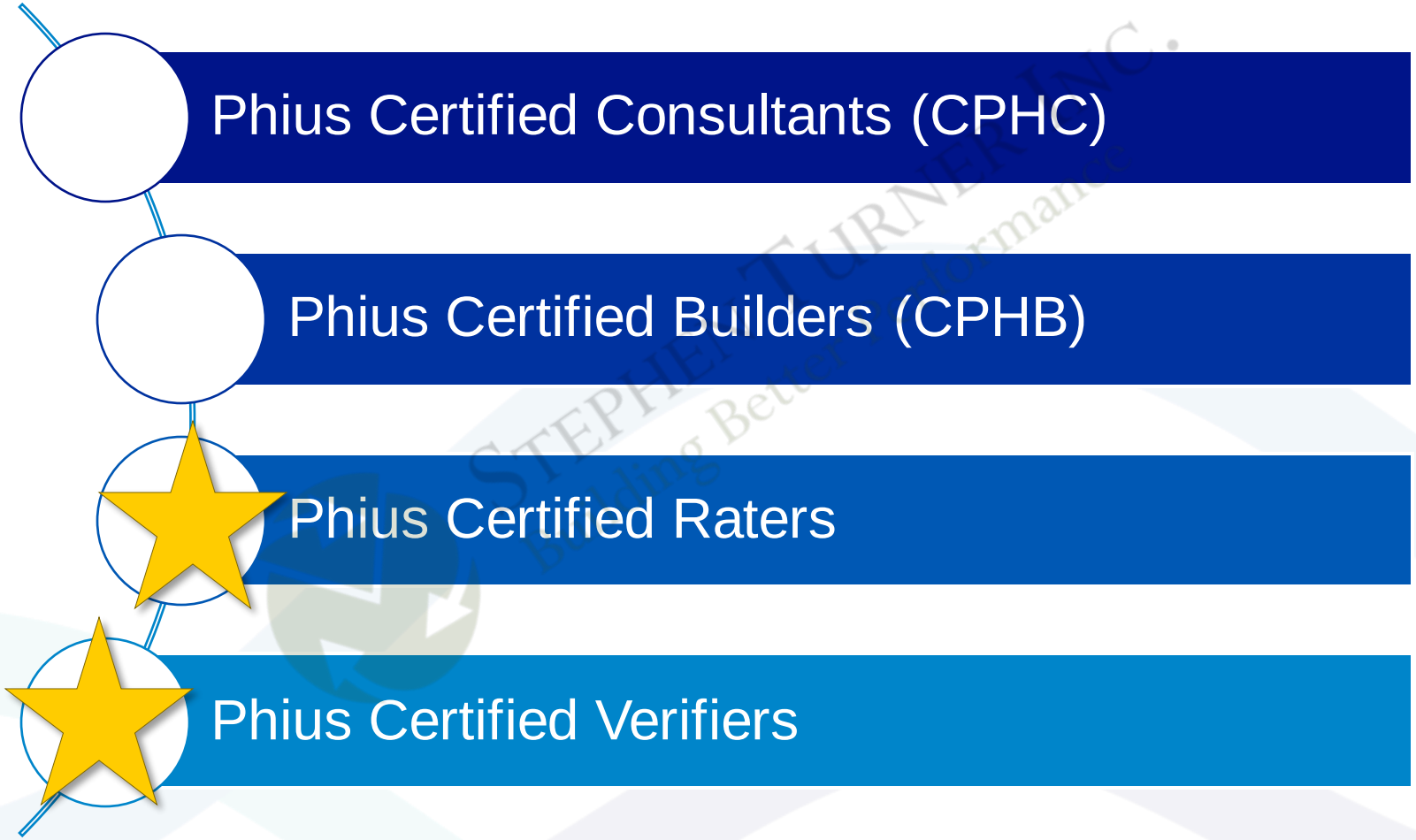
Exhaust and Supply Ventilation
Balanced, with energy recovery

Source: Handel Architects

Varieties of Passive House Building Certifications

- PHIUS CORE (replaced former PHIUS+)
  - Less aggressive
  - Performance or prescriptive paths available
- PHIUS ZERO (replaced former PHIUS+ Source Zero)
  - More aggressive
  - Performance path required
- REVIVE is the renovation certification, available for both CORE and ZERO

Varieties of Passive House Professional Certifications



Six Steps to PHIUS Certification

Source: https://commercial.phius.org/

The fully detailed process can be found here:
https://www.phius.org/certifications/projects/submit-project

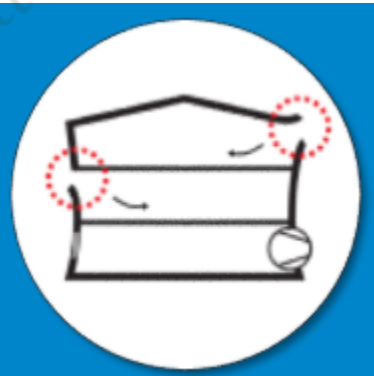
Passive Building Design Fundamentals (1/2)

Thermal Control

Continuous Insulation

Minimize Thermal Bridging

Air Control



Air Tightness

Balanced Ventilation with Heat & Moisture Recovery

Source: phius.org

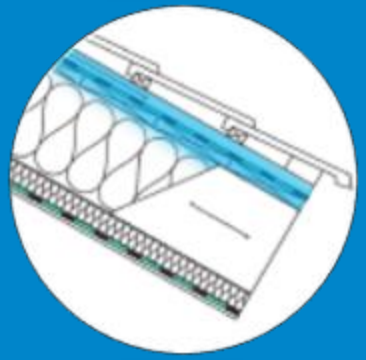
Passive Building Design Fundamentals (2/2)

Radiation Control

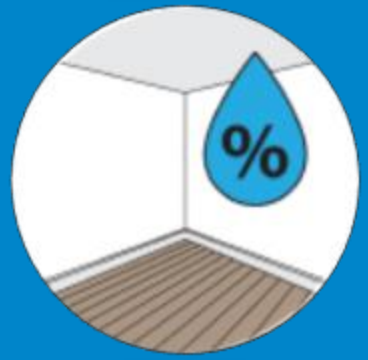
High Performance Glazing

Shading & Daylighting

Moisture Control



Material Moisture



Air Humidity

Source: phius.org

Very Low Loads - New Solutions: The “Magic Box”

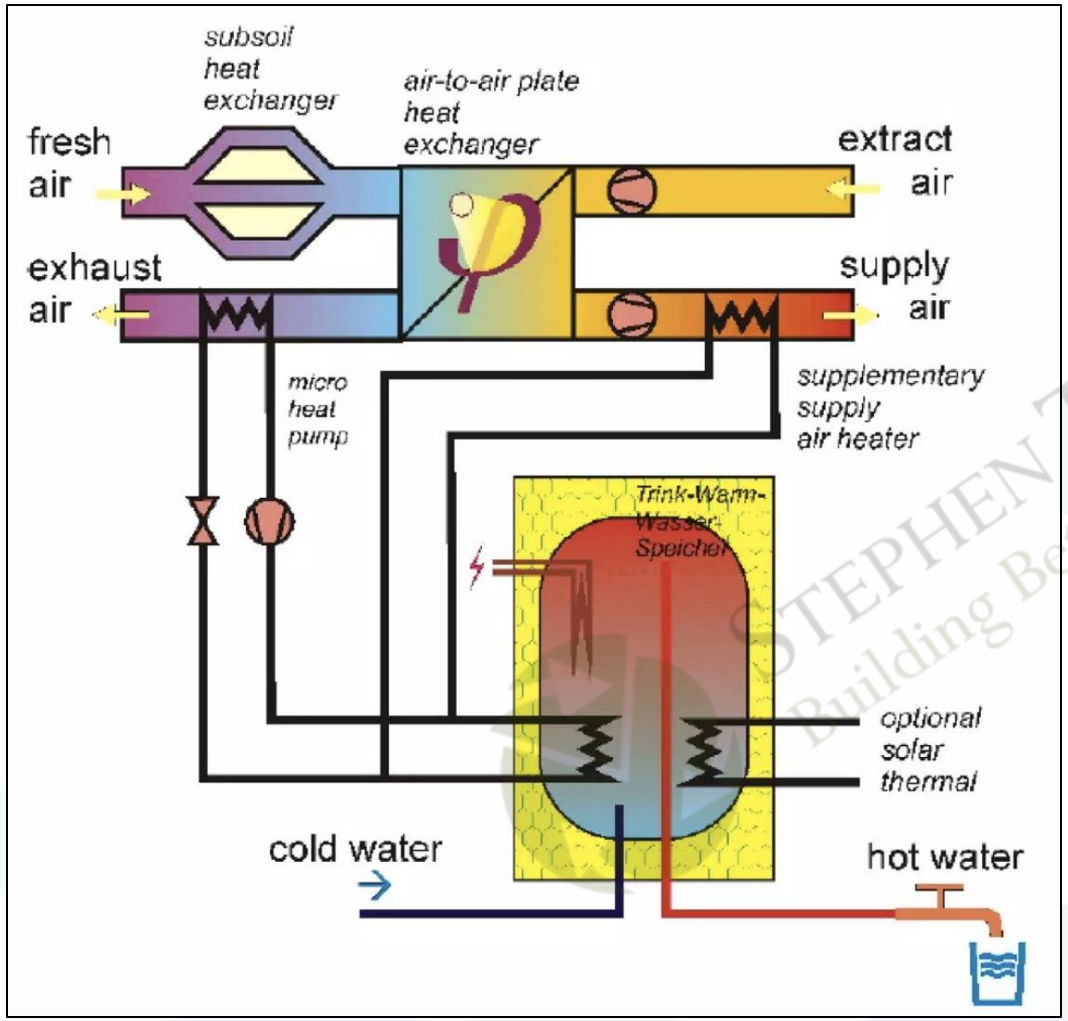


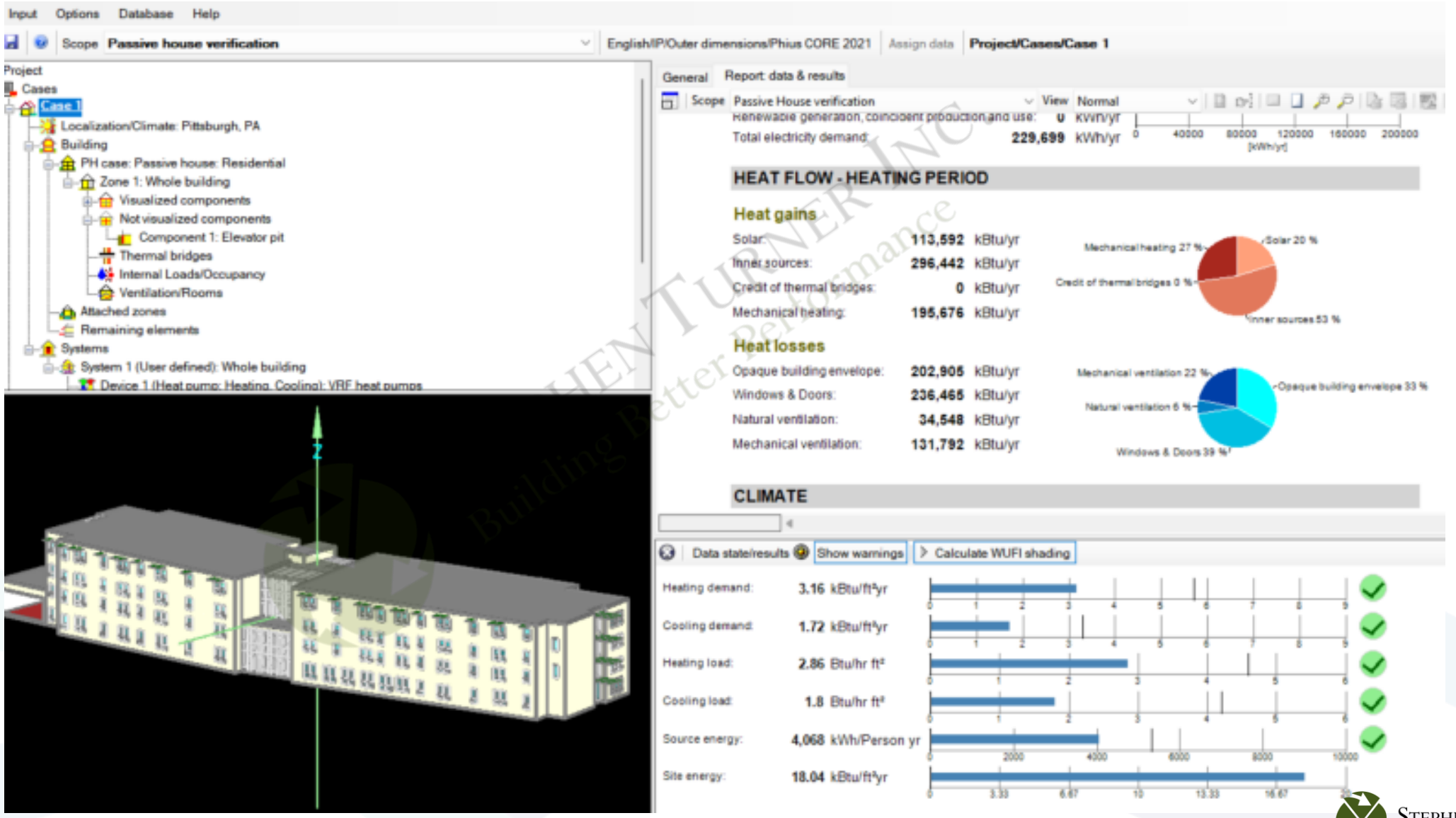
Photo: Passive House Institut

Photo: Inhabitat

- Colder exterior surfaces in winter = less heat available to evaporate water in the assemblies
- The “sensible heat ratio problem”: HVAC dehumidification is still needed when the space temperature setpoint is satisfied and the AC system is off.
- WUFI modeling to the rescue…
  - See wufi.de/en for more info

Challenges of Super-Insulated, Low-Load Buildings

WUFI Modeling



Specific Requirements for Passive House Certification

Benefits of Implementing Passive House

- Comfortable spaces
- High indoor air quality
- Smaller, lower cost HVAC system
- Significantly lower energy use and cost (improved LCC)
- Low carbon footprint
- Quieter acoustics
- Energy code compliance, increasingly
- Resiliency
- Easier to achieve net-zero energy use – less renewables
- Increased property value

Challenges of Implementing Passive House

Cost: historically, ~1-4% added initial cost (but lower Life Cycle Cost)

- Trends to 0% as a project teams gain experience from previous projects
- State/utility incentives can offset the additional costs
- Resources available: https://www.phius.org/resources/policy-work/cost-data

Shift in design approach

Installer knowledge

Product availability

Passive House Cost Estimating Tool

PHIUS+ 2018 Initial Cost Premium & Source Energy Savings Estimator v1

Building Floor Area (ft2)	20,000.00
Method:	CITY DATA
State:	RHODE ISLAND
City:	PROVIDENCE T F GREEI
HDD65 [F.days]	5481
Electricity Cost [$/kWh]	0.1793

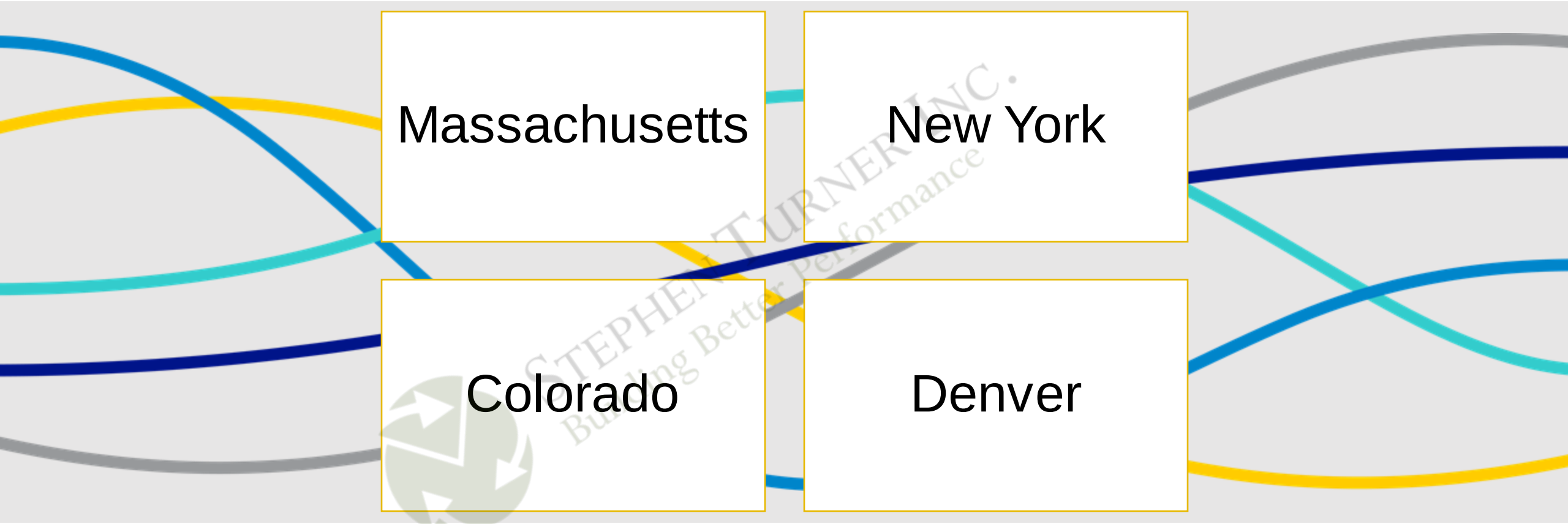
Estimated Initial Cost Upgrade
over BA benchmark (2009)

$/sf	**$7.50**
+ / -	*$2.39*
Low ($/sf)	$5.00
High ($/sf)	$10.00

Estimated % Source Energy Savings
over BA benchmark (2009)

% per year	**58**
+ / -	*5.76*
Low (%)	52
High (%)	64

Read the Tech Corner Article here:
https://www.phius.org/Tools-Resources/TechCorner/Cost&SourceEnergySavingsv2.pdf



Passive House in US Building Codes

Passive House in RI

- Compliance path option for the RI Stretch Code (which in turn is a compliance path option for publicly funded buildings, under the Green Buildings Act)
- Qualified Allocation Plan (federal affordable housing funding)
- RI Energy utility incentive:

Rhode Island Residential New Construction (RNC) Program & Zero Energy Homes

Rhode Island Energy™
a PPL company

2023 Program Description

Rhode Island Energy offers no-cost services and incentives to help you renovate or build an energy efficient home with lower operating costs and increased durability and comfort. Working in partnership with the builder and/or owner, the Residential New Construction (RNC) Program offers energy modeling, design assistance and in-field inspections to help customers achieve energy efficient homes. In addition to the technical support, RNC offers financial incentives to help offset incremental costs for a higher efficiency home.

Program Serves

- New construction, gut rehabs, major renovations & additions
- Adaptive re-use (e.g. mill building conversions)
- Single family, townhouses & apartments
- Market-rate & affordable housing

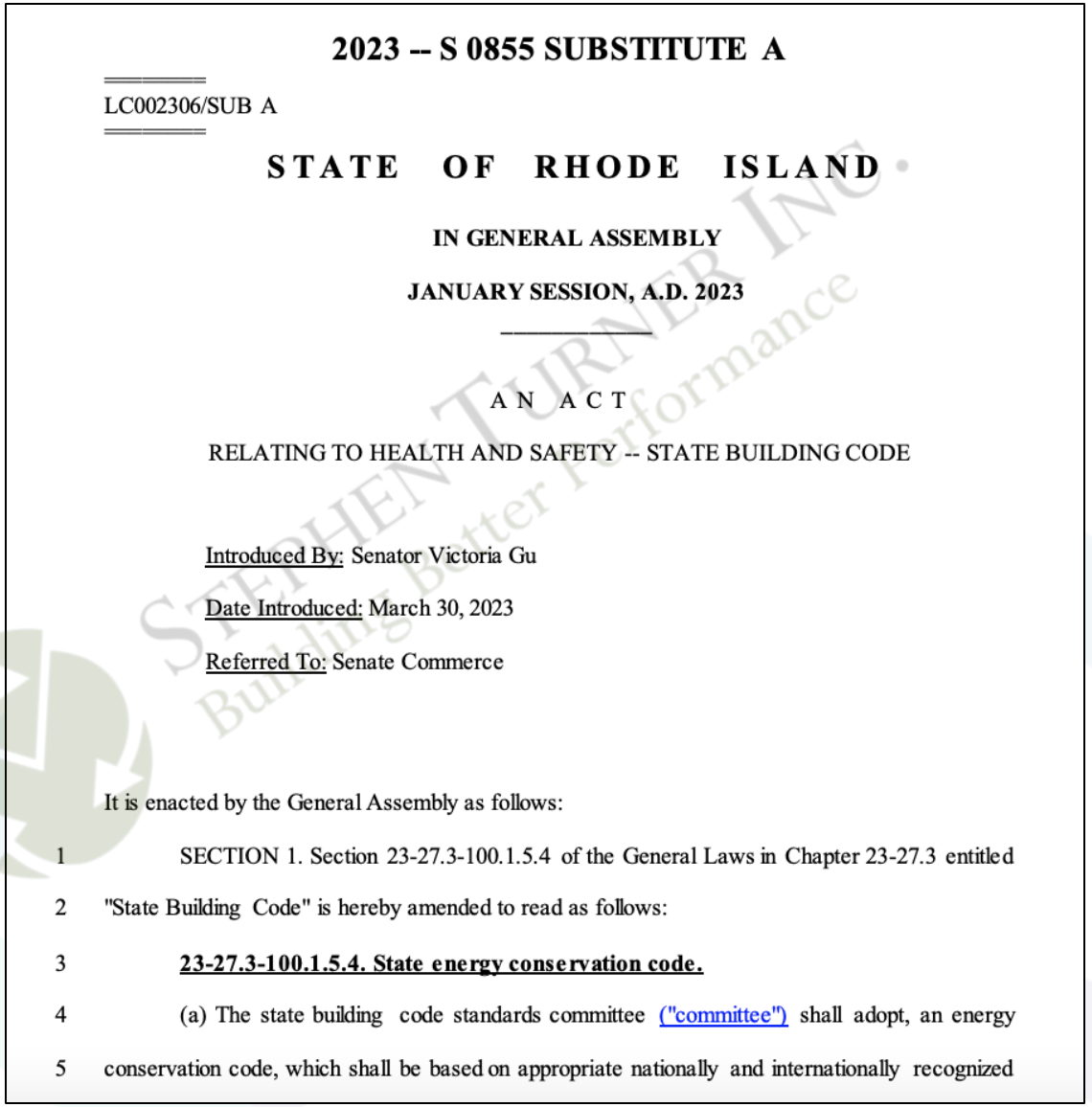
Benefits and Services Include

- HERS Rating
- Optional ENERGY STAR® Homes verification for projects seeking the EPAlabel
- Support for projects seeking additional certifications such as DOE Zero Energy Ready, Passive House/

"Projects seeking Passive House certification (Option B) are eligible to receive incentives in three installments:

- *PHIUS Enrollment/Design Charrette*
- *PHIUS Pre-certification*
- *PHIUS Certification"*

Passive House in RI – Upcoming Energy Code



2023 -- S 0855 SUBSTITUTE A

LC002306/SUB A

STATE OF RHODE ISLAND

IN GENERAL ASSEMBLY

JANUARY SESSION, A.D. 2023

AN ACT

RELATING TO HEALTH AND SAFETY -- STATE BUILDING CODE

Introduced By: Senator Victoria Gu

Date Introduced: March 30, 2023

Referred To: Senate Commerce

It is enacted by the General Assembly as follows:

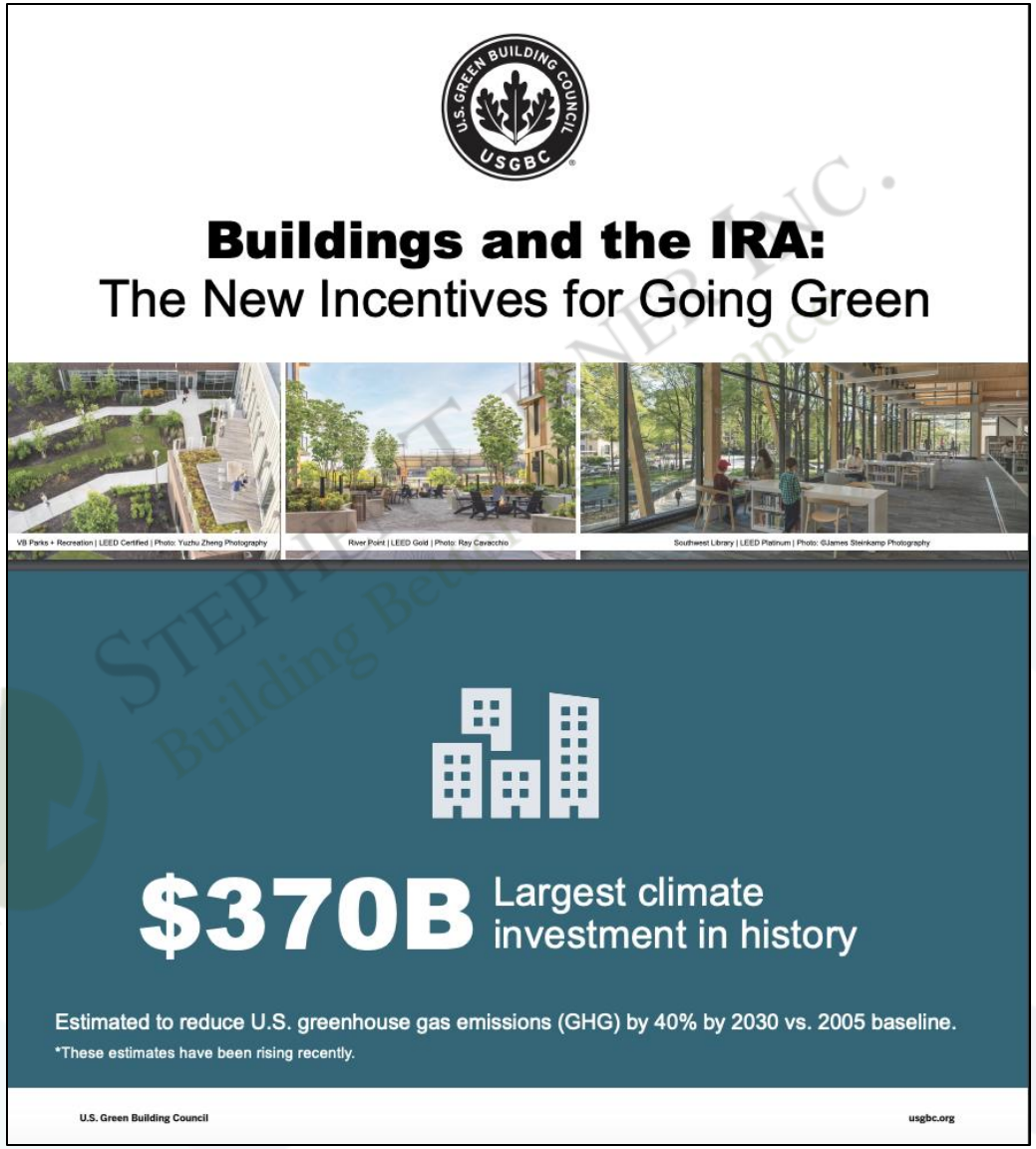
SECTION 1. Section 23-27.3-100.1.5.4 of the General Laws in Chapter 23-27.3 entitled "State Building Code" is hereby amended to read as follows:

23-27.3-100.1.5.4. State energy conservation code.

(a) The state building code standards committee ("committee") shall adopt, an energy conservation code, which shall be based on appropriate nationally and internationally recognized

Source: webserver.rilegislature.gov

Investment Reduction Act – Financial Incentives



Source: usgbc.org

Passive House in MA

Base Code (IECC 2021)

- New construction in towns & cities not a green community
- **52 communities**

Expected from BBRS: **July 2023**

Stretch Code (2023 update)

- New construction in towns & cities that are a green or stretch community
- **299 communities**

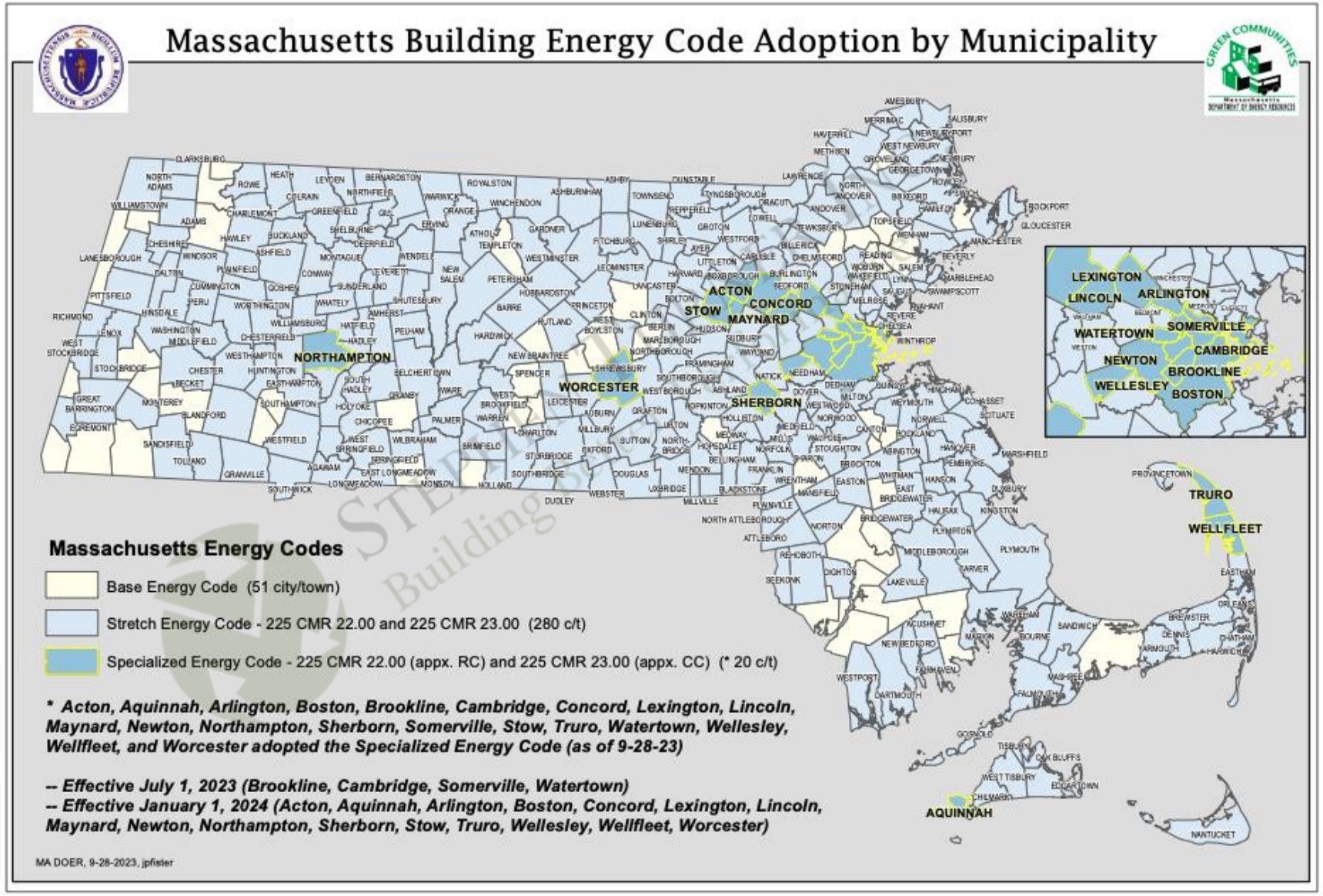
Residential: Jan 2023
Commercial: July 2023

Specialized Code ("Net-Zero")

- New Construction in towns & cities that vote to opt-in to this code
- **Effective date:** Typically 6-11 months after Town/City vote

Source: mass.gov

Passive House in MA

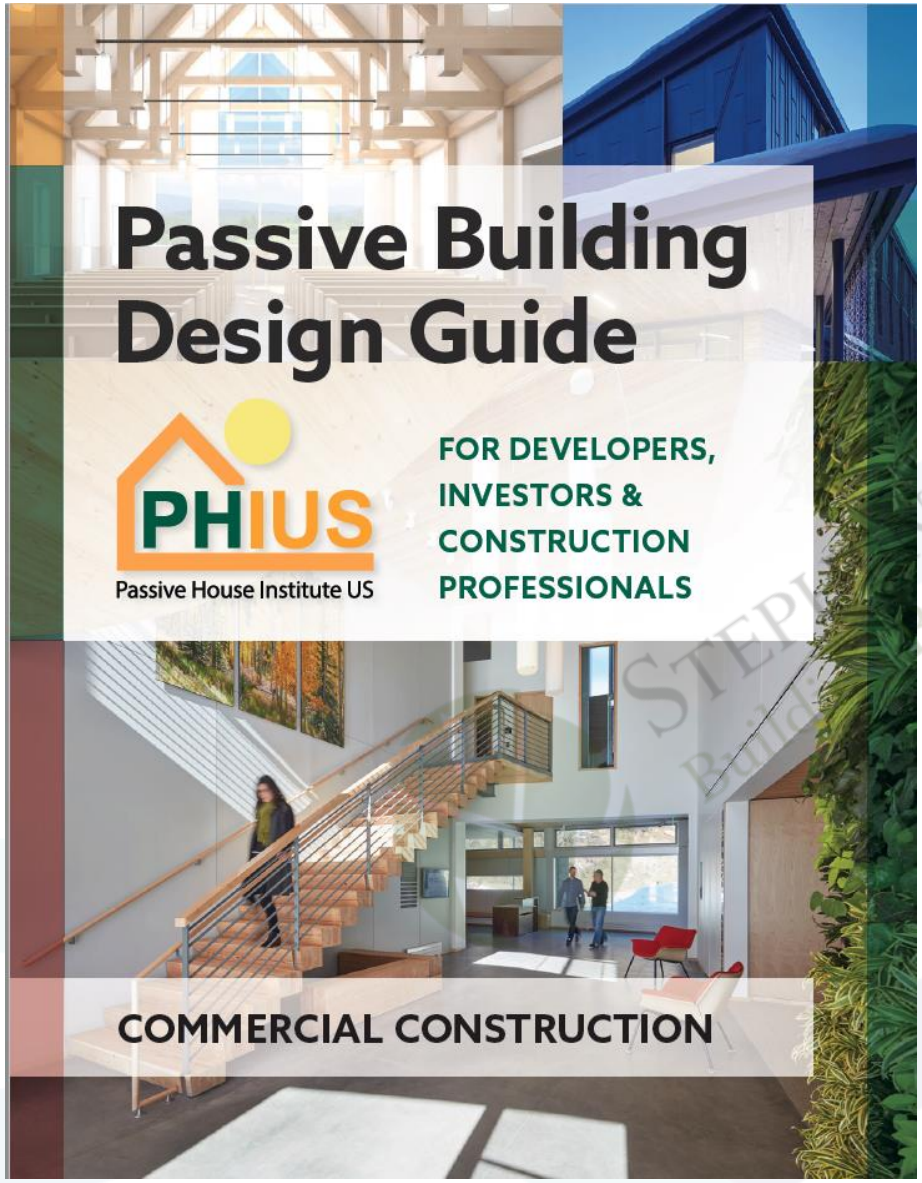


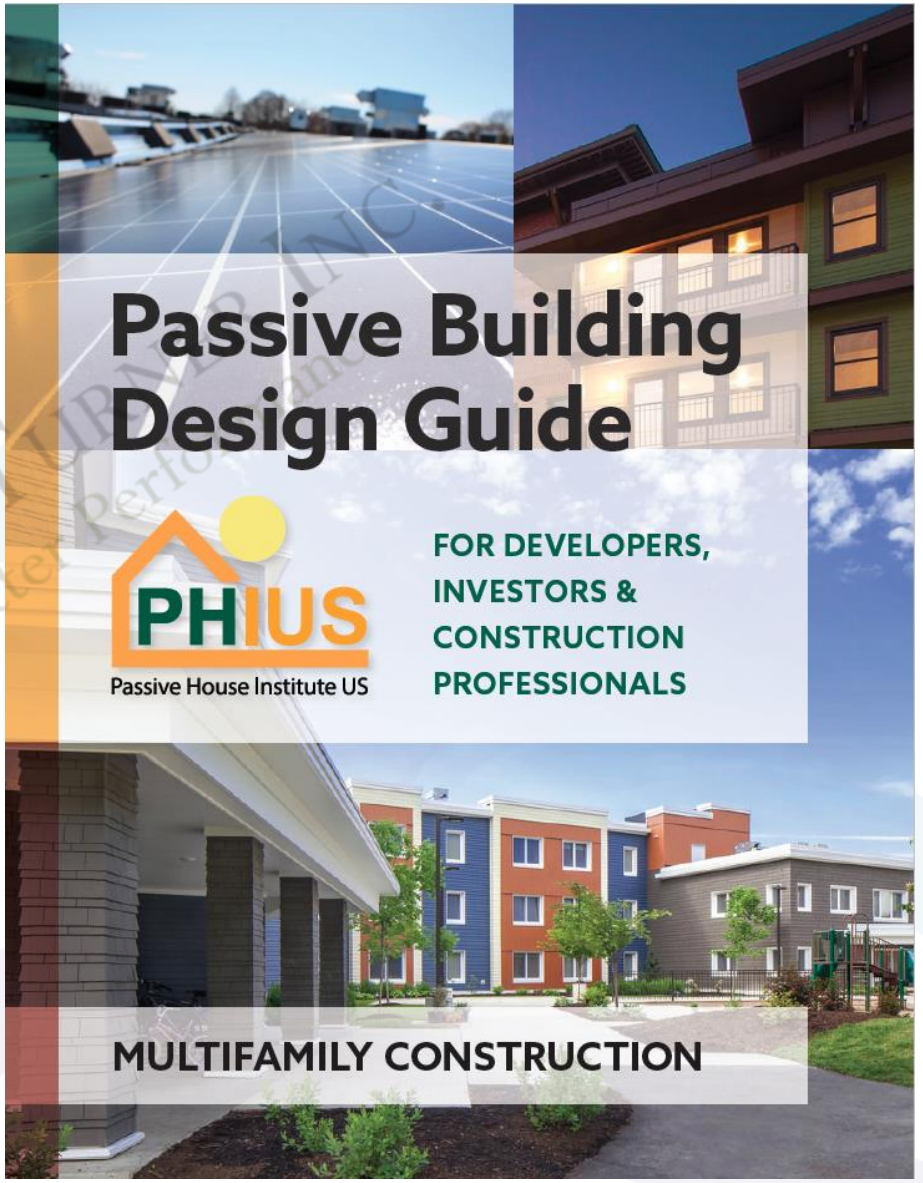
Source: Massachusetts DOER

Resources

- https://www.phius.org - lots of information and tools, calculators
- https://commercial.phius.org/ - commercial/non-residential specific
- PHIUS 2021 - Passive Building Standard Certification Guidebook, v3.2, July 2023
  - https://www.phius.org/phius-certification-guidebook
- https://passivehouseri.org/
- https://passivehousema.org/
- https://phmass.org/

Resources





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